

CANADIAN ELECTRONICS ENGINEERING

AUGUST 1961

A Maclean-Hunter publication

five dollars a year

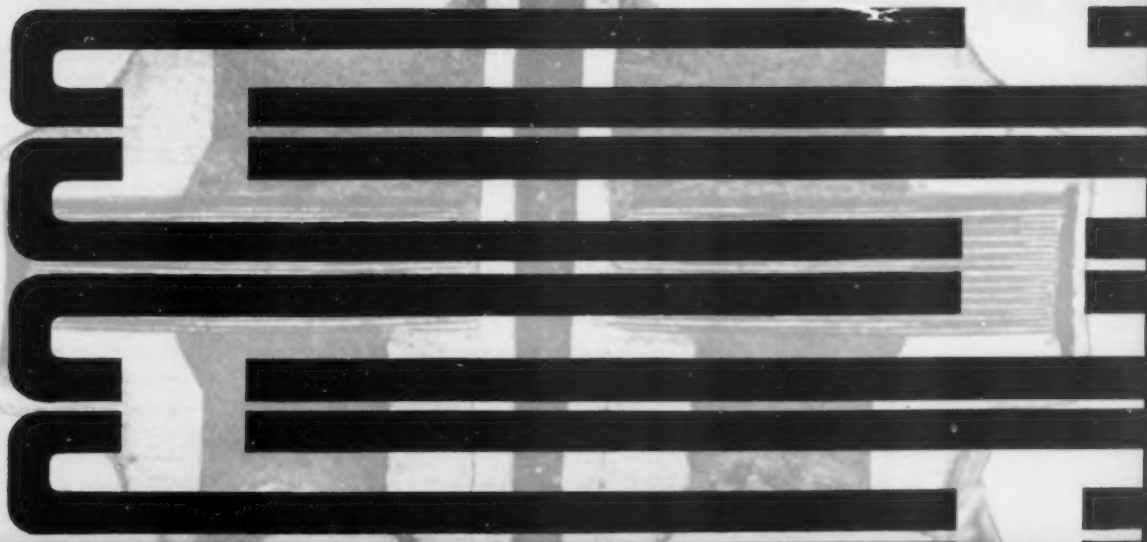
AUG 2 1961

Oblique sounding improves communication system performance

Electronics speeds freight car sorting at CNR Moncton yard

New business machine reads forms for Canada's 1961 census

Operation of button mica capacitors extended to 125 C



RELIABLE OPERATION for SYSTEMS or LABORATORY at 70 kMc ENTIRELY DEVELOPED AND PRODUCED IN CANADA

LABORATORY SERVICE

Superior Performance As:

- Bench Oscillator
- Pump Source
- Signal Generator in Test Equipment

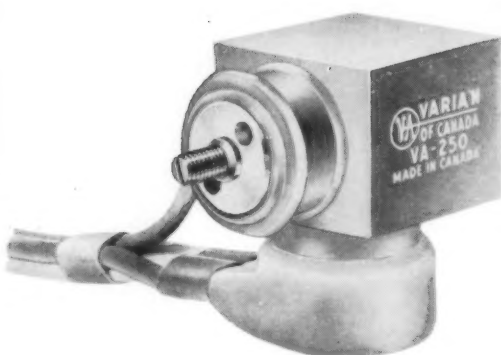
Beam Voltage	— 2500 VDC
Beam Current	— 20 mADC
Power Output	— 150 mw to 250 mw
Frequency Range	— Any 6 kMc Band
	— 62.0 - 75.0 kMc

The klystron is rugged, stable in frequency and power output, with simplified tuning using a single screw.

LOW POWER SYSTEMS SERVICE

The resistance of the tube to severe environment coupled with ease of tuning and low power drain make the tube ideal for use as local oscillators in advanced systems.

Beam Voltage	— 1400 VDC
Beam Current	— 10 mADC
Power Output	— 10 - 20 mw
Electronic Tuning Range	— 150 mc/s
Frequency Range	— Any 6 kMc Band
	62.0 - 75.0 kMc



VA-250 (shown actual size)



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CANADIAN ELECTRONICS ENGINEERING

Volume five number

8

August 1961

New button mica capacitors feature good UHF performance up to 125C

Hermetically sealed button mica capacitors, capable of operating from -55 to $+125$ deg C, have been developed under an ECRDC contract in both feed-through and stand-off versions. They feature good UHF performance and exceed the requirements of MIL-C-10950B.

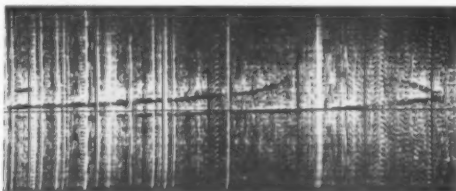


G. C. Robinson hails from Tenbury Wells, England, and received his BA degree from Oxford University in 1947. After service in the Royal Signals he joined the British Electrical and Allied Research Association in 1950, where he worked on capacitors and resistors, with particular emphasis on aluminum oxide dielectrics. He joined Erie Resistor of Canada Ltd. in 1957 and is now Senior Engineer, Research and Development.

25

Oblique ionospheric sounding improves communication system performance

Accurate prediction of the best operating frequency for HF communication systems has always been a problem. Philips Electronics Industries has developed oblique ionospheric sounders that can provide information to help an operator select the best frequency for his communications.



28

Business machine reads census forms

Canada's 1961 census has produced nearly 500,000,000 bits of information which must be analyzed. The mammoth task is being made easier by a special document reader which can scan census forms completed by enumerators, then translate the information into binary code on magnetic tape for processing in a high-speed computer.



Census documents being loaded into the IBM document reader are "read" at rate of 150 a minute and information is put on magnetic tape. Equipment was developed by IBM at Endicott, N.Y.

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Defence electronics procurement topped \$133 million in 1960

This is a summary of news pertaining to electronics and contained in the Tenth Report of the Department of

Defence Production for the year 1960. It includes news on the defense production sharing program

32

Electronics speeds freight car sorting

A special analog computer, data processing equipment, closed-circuit television, two-way radio, teletype, and tape recorders all play a part in speeding the sorting of freight trains in CNR's new classification yard at Moncton, N.B. This is the forerunner of three more such yards to be built over the next few years.



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SERVING CANADA THE NORTHERN WAY

15,000 Northern People . . . individuals all with different personalities . . . different lives . . . holding various positions . . . making numerous products . . . but all linked together by a common bond as a member of the Northern Electric family, in the design, manufacture, and installation of a large proportion of Canada's telephone communication systems and equipment. ■ They produce all types of electrical wire and cable for communication and power transmission, and distribute a complete line of electrical apparatus and supplies. ■ At Northern Electric, product research and development never stops, and continuing progress is made in the communication, electrical wire and cable fields.

Northern Electric
COMPANY LIMITED

Soviet industries make increasing use of electronic control techniques

The Soviet Union is attempting to increase its gross industrial output 80% during the period 1958-65. To accomplish it, they are relying extensively upon electronics. This picture shows automatic control panels at the Okhta polyethylene chemical factory in Leningrad.



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Engineering reports

41

Telemetering equipment uses photoelectric cells to produce teletype signals

Rotating head scans segments of magnetic tape for close analysis of information

Language laboratory offers versatile control features to teacher and students

Departments

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Correction

An error occurred in the article, "Simple holders for crystal detectors feature low VSWR, high sensitivity," by A. Stanforth and J. K. Puffer, CEE, July, 1961, page 31. Throughout the article, reference was made to frequency in Nanocycles (Nc); this should have been Gigacycles (Gc). Giga equals 10⁹.



Inductance...

10000
mh

General Radio offers a wide line of fixed and variable standard inductors.

Toroidal air-cored inductors, such as the Type 1482 Standard Inductor, approach the ideal; stability is high, effects of external magnetic fields are negligible, temperature coefficient is low, and inductance changes with current are minimized.

Greater economy in coil construction can be obtained using "iron" (special ferromagnetic alloys) as the core material. Although there is some sacrifice in stability, properly designed iron-cored inductors exhibit a higher Q than air-cored types, and are excellent secondary standards.



Type 1482
Standard Inductors
17 models
from 50 μ h to 10 h in 1-2-5 sequence.

Primary standard for measurements at low audio frequencies featuring high stability, high adjustment accuracy, and high certification accuracy. Uniformly wound toroid on ceramic core — negligible external magnetic field and practically no pickup. Thermal aging equalizes winding strains. May be used for either two- or three-terminal measurements — 50- μ h, 100- μ h, and 200- μ h values have six terminals for minimizing connection errors. Low temperature coefficient of 30 ppm/°C. Adjustment accuracy is $\pm 0.1\%$ for values between 500 μ h to 10 h; $\pm 0.25\%$ for 100 μ h and 200 μ h; and $\pm 0.5\%$ for 50 μ h. Typical certification of actual value given to better than $\pm (0.025\% + 0.1 \mu$ h) — long-term stability better than 0.01% per year. Prices from \$110 to \$225.



Type 1481 Inductors
16 models
from 100 μ h to 10 h
in 1-2-5 sequence.

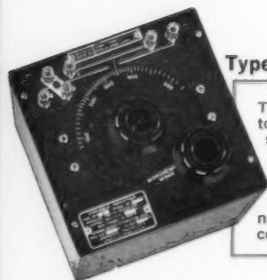
Extremely useful secondary standards for two-terminal measurements — toroidal winding on molybdenum-permalloy dust core; higher low-frequency Q values than 1482 models... electrostatically shielded. Adjustment accuracy is $\pm 0.4\%$ for 100-mh through 10-h values; $\pm 0.6\%$ for 10-mh through 50-mh values; $\pm 1.0\%$ for 500- μ h through 5-mh values; and $\pm 2.0\%$ for 100 and 200- μ h values. Stability better than 0.25% per year. Prices from \$37.50 to \$50.00.

Type 940 Decade-Inductor Units

Assemblies of four Type 1481 Inductors which are combined by switching to give eleven successive values from 0 to 10. High Q values for all models. Wax impregnation keeps out moisture — aluminum covers provide electrostatic shielding.

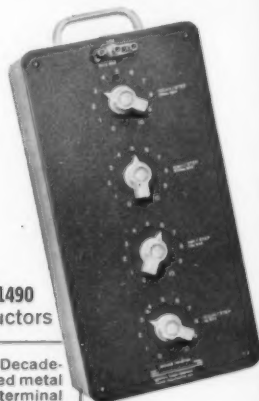


Type	Range	Accuracy	Price
940-DD	1 mh, total, in 100- μ h Steps	$\pm 2\%$	\$110
940-E	0.01 h, total, in 1-mh Steps	$\pm 2\%$	\$110
940-F	0.1 h, total, in 0.01-h Steps	$\pm 1\%$	\$110
940-G	1 h, total, in 0.1-h Steps	$\pm 0.5\%$	\$110
940-H	10 h, total, in 1-h Steps	$\pm 0.25\%$	\$120



Type 107 Variable Inductors

Two concentrically-mounted coils are used as stator and rotor to provide continuous adjustment of self and mutual inductance. May be connected in series or parallel. Basic calibration accuracy is $\pm 1.0\%$ of full scale. Five models available with following series-connected values: 9-50 μ h; 90-500 μ h; 0.9-5 mh; 9-50 mh; 90-500 mh. When connected in parallel, inductance is $\frac{1}{4}$ of series-connected values. Prices range from \$95 to \$110.



Type 1490 Decade Inductors

Assemblies of Type 940 Decade-Inductor Units in shielded metal cases — for 2- or 3-terminal measurements.

Type	Range	Price
1490-C	1.11 h, total, in 1-mh Steps	\$360
1490-D	11.11 h, total, in 1-mh Steps	\$460
1490-F	1.111 h, total, in 100- μ h Steps	\$490

Write for Complete Information

GENERAL RADIO COMPANY

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The Best Instruments
in Electronics

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NEWS HIGHLIGHTS

**Prime Minister opens \$25-million
1,200-mile microwave network between
Grande Prairie, Alberta and Mount
Dave on Yukon-Alaska border.
Huge project completed on schedule.**

A telephone call to President John F. Kennedy in Washington, D.C., placed by Prime Minister John G. Diefenbaker from Whitehorse, Yukon Territory on July 22 marked the completion of Canada's largest single microwave system.

Canadian National Telecommunications owns the system and was the prime contractor for the \$25-million project. RCA Victor Company Ltd. was the principal sub-contractor, supplying the microwave equipment for the 42 relay stations located at 30-mile intervals along the route.

The 600-channel system will provide greatly improved telephone and telegraph communications facilities in the Canadian northwest, and will serve as a major link between Alaska and the continental United States.

Starting at Grande Prairie, Alberta, about 450 miles north of Edmonton, the CNT line heads north through the province, cuts through the northeast corner of British Columbia, and then, following the Alaska Highway through the Yukon, joins the interchange link at Mount Dave on the Yukon-Alaska border.

At Grande Prairie the CNT system joins the Alberta Government Telephone system running through Coutts, Alta., thence to the Canada-U.S. border at Sweetgrass, Montana, where it cuts into existing U.S. networks.

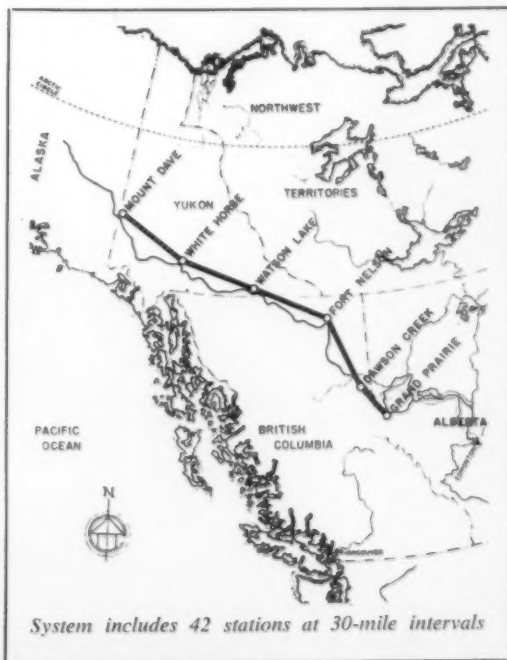
The project was completed in 21 months from the start in September 1959, despite the fact that close to 80 miles of road had to be pushed through bush, muskeg and permafrost. More than 1,000 acres of land was cleared and graded for roads and building sites, two of which are on top of mountains. At two other locations bridges had to be installed across rivers to provide access to the sites. The mountain-top stations involved the construction of aerial tramways to transport equipment and materials, one of them 5,200 feet long with a rise of 2,300 feet.

The towers along the network range in height from 50 feet to 350 feet, and carry ten-foot diameter parabolic reflectors for the antennas. Commercial power is only available at six of the sites, the others having no-break diesel generators. The MM-600 radio relay equipment, which is capable of expansion to 3,000-channel capacity, is provided with a completely automatic supervisory system.

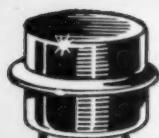
Note: The monthly charts showing sales of radio and television receivers and record players have been temporarily discontinued. More comprehensive data, based on DBS figures, will appear on this page, commencing with the October issue.



Prime Minister Diefenbaker officially opened the system in a ceremony at Whitehorse, Yukon Territory. Fourth from left is J. R. White, general manager of Canadian National Telecommunications. J. D. Houlding, president of RCA Victor, is at extreme right.



System includes 42 stations at 30-mile intervals



NEW FROM PHILCO

HIGH FREQUENCY NPN SILICON DIFFUSED-BASE TRANSISTORS

**30mc
PULSE RATE
SWITCHES**

Type Number	h_{fe}	Typical Power Gain	Typical Switching Times (Saturated Test Circuits)
2N1199	12-60(DC)		t_r 35 μ sec t_s 10 μ sec t_f 25 μ sec
2N1267	6-18	25 db at 4.3 mc	
2N1268	11-36		
2N1269	28-90		
2N1270	6-18	25 db at 12.5 mc	
2N1271	11-36		
2N1272	28-90		
Maximum V_{cb} —20 V Maximum temperature—150° C Maximum dissipation—100 MW			

**60mc
AMPLIFIERS**

2N1199

This high speed switch has exceptionally low saturation voltage (typically 0.125 V), permitting practical design of 5 mc pulse circuits, using conventional saturated switching configurations. 30 mc pulse rates are obtainable in practical circuits using non-saturating techniques.

2N1267-68-69

The high gain characteristics of these units make possible the design of high efficiency IF amplifier circuits for communications equipment. These devices have unusually low collector capacitance . . . typically 1.5 μ f . . . and are available with restricted beta ranges to simplify design problems.

*SADT... Trademark Philco Corp. for Surface Alloy Diffused-base Transistor

2N1270-71-72

The excellent high frequency response of these transistors makes practical the design of high performance communications systems at frequencies up to 60 mc. They have the same low collector capacitance and are available with restricted beta ranges.

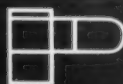
Philco Corporation of Canada,
Don Mills, Ontario

Please send complete information on the SADT type transistors and descriptive brochure of all type transistors available.

NAME _____

ADDRESS _____

CU 8



PHILCO

government and
industrial division

PHILCO CORPORATION OF CANADA LIMITED, DON MILLS, ONTARIO

TRANSISTOR DISTRIBUTORS—ONTARIO—Electro Sonic Supply Co. Ltd., 543 Yonge Street, Toronto • QUEBEC—Canadian Electrical Supply Co. Ltd., 275 Craig St. W., Montreal • NEW BRUNSWICK, NOVA SCOTIA, NEWFOUNDLAND—Commercial Equipment Ltd., King St., Saint John, N.B.

For further information mark No. 33 on Readers' Service Card

CANADIAN ELECTRONICS ENGINEERING AUGUST 1961

"Father of radio," Lee de Forest died last month at 87

Dr. Lee de Forest, affectionately known as "the father of radio," died quietly in his sleep at his Hollywood home last month.

Although hampered by illness and failing sight, Dr. de Forest continued his research until the end. Investigations in thermoelectricity occupied his mind in recent months.

Dr. de Forest is best known for inventing the three-electrode vacuum tube in 1906. With it was born the electronics industry. A great individualistic inventor, Dr. de Forest patented more than 300 inventions in radio, telephony, sound recording and transmission, motion picture sound recording, color television, and others.

He was not content just with providing technical means for establishing a radio and television industry. He spoke out on many occasions against the use of this powerful communication medium for quick financial gain. He felt that it should be used wisely to help improve the knowledge of man.

Born in Council Bluffs, Iowa, in 1873, Dr. de Forest has succeeded in building his own lasting memorial — scientific contributions which benefit everyone.

Dr. E. O. Hughes of the National Research Council, Ottawa, has been appointed Scientific Attache in the Canadian Embassy in Washington.

In this position, Dr. Hughes will be responsible, under the Ambassador, for scientific questions at the Embassy. He will also serve as Canadian liaison officer at the British Commonwealth Scientific Office.

Dr. Hughes is replacing Mr. H. Williamson, who is returning to Ottawa.

Dr. J. B. Mawdsley has been appointed dean of engineering at the University of Saskatchewan.

Dr. Mawdsley has been head of the department of geology since 1929 and will relinquish that position. A successor has not been named.

As dean of engineering, he succeeds Dr. A. Porter who has been appointed first professor of industrial engineering at the University of Toronto (CEE, April, page 7).

Dr. Mawdsley is also director of the Institute for Northern Studies set up at the university early last year.

Recently he was elected president of the Canadian Institute of Mining and Metallurgy.

Three appointments have been made at Measurement Engineering Ltd.

P. C. Boire has been appointed managing director, manufacturing division. He has held the position of chief engineer since joining the company in 1949.

W. O. Forde becomes plant manager. He joined Measurement Engineering in 1959, after serving with Philips Electronics Industries, and Canadian Applied Research.

H. French, chief inspector since 1950, has been appointed manager of quality control department.



Boire



Forde



French



Webber



Carman



Merritt

Three management appointments have been announced in the electronics division of Canadian Westinghouse Co.

Harry Webber, former manager of radar and airborne electronics engineering, has been appointed manager of the engineering department. He graduated from Edinburgh University

and joined Canadian Westinghouse in 1954.

J. K. Carman has been named manager of the manufacturing department. His previous post was superintendent, industrial and manufacturing engineering. He graduated from the University of Toronto in 1950.

H. J. Merritt has been appointed manager, marketing department. For the past few years he has been manager of radar and airborne electronics marketing. He graduated from the University of Toronto in 1951 and joined the company the same year.

Esna Canada Ltd., Toronto, has appointed John R. Lindsay as vice-president.

Mr. Lindsay was formerly executive vice-president of A. Johnson & Co. (Canada) Ltd., Montreal. Esna manufactures and distributes Agastat time delay relays, Buchanan electrical connectors and Esna airport lighting products.

A. C. Taylor has been appointed zone sales manager-government, Burroughs Business Machines Ltd.

In his new position, Mr. Taylor will be located in Ottawa where he will be in charge of Burroughs activities in connection with all federal government departments and agencies. He replaces A. J. Bardach who has been transferred to Saint John, N.B., as manager of the company's new branch office.

University of Waterloo elects new chairman of industrial advisory committee.

Dr. J. W. Tomecko of Montreal has been elected chairman of the committee, succeeding J. H. Balwin, manager of the engineering products division of Honeywell Controls Ltd. Dr. Tomecko is educational relations manager of Canadian Industries Ltd. The council is a 30-member group of senior representatives from Canadian industry formed in 1958 to bring guidance from industry to the uni-operative engineering course.

Lawrence E. Nelson, of the Department of Transports Telecommunications Branch becomes Regional Superintendent of Radio Regulations, Edmonton Region.

Mr. Nelson has been with the Transport Department in the field of telecommunications since 1937, when he entered the service at Coleman, Alta. Since that time he has been employed in Calgary, Winnipeg, Regina and Whitehorse, prior to moving to Ottawa three and a half years ago.

(Continued on page 53)

LITTON ALL-INERTIAL AUTOMATIC NAVIGATOR INSTALLED IN AN OPERATIONAL FIGHTER



NEW PROOF OF LITTON'S CONTINUING CONTRIBUTIONS TO THE DEVELOPMENT OF INERTIAL NAVIGATION IS FURNISHED BY THE LN-3-2B AUTOMATIC NAVIGATOR THAT IS NOW BEING INSTALLED IN CANADA'S CF-104 FIGHTER.

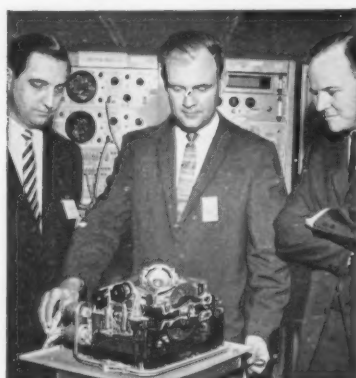
Three-hundred-and-sixty-degree freedom of aircraft maneuver on every axis is made possible by four-gimbal isolation of the Litton stable platform that keeps the system's accelerometers aligned in inertial space. Voltage signals from the accelerometers are transmitted to a computer where they are integrated to compute vehicle position components.

In addition, an adapter unit provides 27 outputs of pitch, roll and heading angles and ground speed to other equipment in the aircraft such as bombing computer and autopilot.

In flight, tight servo loops hold all sensitive elements of the stable platform at null regardless of acceleration. Any relative motion between the gyro case, which is fixed to the platform, and the floated gyro rotor, which is fixed in space, is sensed and corrected to keep the platform including accelerometers oriented to vertical and north. Any acceleration along an axis produces an accelerometer torquer current which is proportional to the applied acceleration. This torquer current holds the accelerometer at null, and the same signal is transmitted to the navigation computer.

Litton Systems (Canada) Ltd. is playing an increasingly vital role in Canada's CF-104 program. At its Rexdale facility the company is undertaking:

- The manufacture of electronic sub-systems for the LN-3.
- The final test and calibration of the complete LN-3 system.
- The design and manufacture of ground support and other special purpose electronic test equipment.
- The training of R.C.A.F. and industry personnel.
- After-sales service including provision of spares and field representation.
- Maintenance, repair and overhaul.



EXAMINING LN-3 STABLE PLATFORM UNDER TEST AT LITTON'S WOODLAND HILLS, CALIF. FACILITY ARE L-R: VIC SYMONDS, LITTON-CANADA; P. LITTON, LITTON-CALIF.; B. DELVEA, DDP.

These programs are being carried forward by engineers and technicians specializing in inertial navigation and related techniques.

If you have experience in fire control, analog, servo or gyro systems this may be your opportunity to gain further knowledge in this continuously expanding field in Canada with one of the world's leaders in inertial navigation systems. Opportunities also exist for field service representatives. To apply, write to Personnel Manager, Litton Systems (Canada) Limited, 123 Rexdale Blvd., Rexdale, Ontario.



**LITTON SYSTEMS
(CANADA) LIMITED**
Rexdale, Ontario

DIVISION OF LITTON INDUSTRIES
BEVERLY HILLS, CALIFORNIA

COTC records new high revenues in eleventh profitable year

Canadian overseas telecommunication facilities provided a record net profit of \$1,363,751 during the last fiscal year, according to the eleventh annual report of the Canadian Overseas Telecommunication Corporation.

In submitting the report, Douglas F. Bowie, president and general manager of the corporation, stated that over-all revenue increased by 25.9% compared to the previous year in overseas telegraph, telephone, International Telex and leased circuits, to mark the eleventh successive profitable report since the formation of the Crown agency.

The Canadian mainland shore-end of COTC's new trans-Atlantic multi-purpose cable was spliced last month at Grosses Roches, Que. The 380-mile St. Lawrence section extends to Corner Brook, Nfld., and will provide 120 voice-grade circuits, the greatest number so far attempted in a cable. The complete trans-Atlantic section of the Commonwealth round-the-world cable is expected to be in service by November of this year.

The second link in the system will be the Pacific cable between Vancou-

ver, Wellington, N.Z., and Australia via Hawaii and Fiji. This is scheduled for completion in early 1964.

Sales representatives take on new lines

Electronic Controls Ltd., Belleville, Ont., has been appointed as Canadian sales engineering representative for **Ekco Electronics Ltd.**, England (industrial nucleonic gauges), nucleonic instruments for scientific and medical research, radiation monitors).

David R. Beattie, Toronto, is now the representative in Canada, except B.C., for **Itek Electro-Products Co.** (crystal filters and discriminators, comb filter sets, voltage control crystal oscillators, etc.). Electronic Laboratories Corp., Torrance, Calif., formerly represented by Beattie, is now a sales division of Itek.

Canadian Electrical Supply Co. Ltd., Montreal, Toronto, Ottawa and Quebec City, sole authorized Canadian distributor for **Texas Instruments Inc.**, is now stocking the complete range of values of TI Tanticap tantalum capacitors.

(Continued on page 50)

Ottawa report

Canadian government initiative could result in agreements between major producing and consuming countries to settle the problem of low-wage imports on an international basis, reliable sources report.

This problem grows in intensity year by year as countries such as Japan, Hong Kong, India, Pakistan and Ceylon build up their capacity for secondary manufacture and start looking for overseas markets.

International agreements will be sought similar to those now existing on raw materials such as tin and sugar. These provide essentially an accepted system of pricing and control over both exports and imports.

An agreement on low-wage imports would aim to assure markets for the goods of underdeveloped countries and keep sufficient control over these exports that production and employment in any consuming nation is not severely damaged.

For Canada the benefit will be a sharing of the load of competitive low-cost goods which are not now spread evenly

(Continued on page 50)



J. A. Norton, vice-president operations and one of the founders of Computing Devices of Canada Ltd., Ottawa, greets Mrs. Jean Winter, the company's 1,000th employee. C. F. Hembury (at right) CDC's president and general manager, shows his pleasure at this important milestone in the company's history. Started in 1948 as a small research company working with digital computers, CDC has grown in this short time into a recognized leader in the field of dead-reckoning air navigation systems, exporting the major portion of its production.

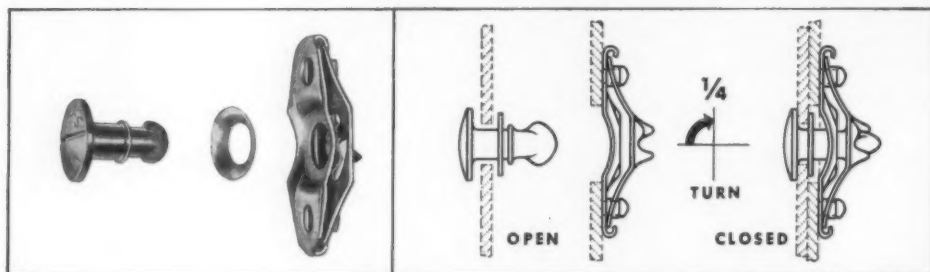


IBM 705 data computing equipment attracts attention during recent tour of Air Materiel Command HQ at Rockcliffe, Ont., by members of the Air Industries and Transport Association. Left to right: Air Commodore V. S. J. Millard, Chief of the Logistics Division at AMCHQ; Air Vice Marshal Clare L. Annis, Air Officer Commanding; L. W. Smith, vice-president and general manager, Montreal Division, Bristol Aero-Industries; and John H. Baldwin, general manager, Engineered Products Division, Honeywell Controls, Toronto.

THIS PANEL CAN BE
OPENED OR CLOSED
IN LESS THAN 2 SECONDS

LION $\frac{1}{4}$ TURN OPEN FASTENERS

ARE FAST, POSITIVE, RELIABLE



Installation of the three parts of the Lion Fastener, shown above, is quick but not critical. Unique in design and performance, these mil spec (MIL-F 5591A-ASG) fasteners make possible quick access and smooth positive locking by only a $\frac{1}{4}$ turn.

ALIGNMENT NOT CRITICAL

Both stud and receptacle "float" to accommodate misalignment. The hole, which retains the stud, is twice as large as the stud cross-section. This permits a float of .070 in all directions. The leaf spring receptacle also floats to accommodate stud position.

WIDE VARIATIONS IN STACK HEIGHT
Total sheet thickness may vary as

much as $+.035$ and $-.015$ without affecting operation. A Lion stud, specified for .160 total thickness, for example, will accommodate any stack height between .195 and .145.

SWAGED-NOSE STUD

Extra strength and smooth operation are made possible by the swaged-nose design. All the metal in the stud goes to work. There are no thin cross pins, holes or milled slots to weaken the cross-section. Case hardening is further assurance of long, trouble-free service.

WIDE VARIETY

Lion Fasteners are available in 3 sizes—No. 5, No. 2, and Miniature.

An assortment of head styles are supplied—oval, flush, wing, ring, notched or knurled—according to individual requirements.

FREE!

**FASTENER
HANDBOOK**



Send for your free copy of Southco Fastener Handbook No. 9. Gives complete engineering data on Lion Fasteners and other special fasteners.

Write to your nearest distributor listed below.

LION *Aviation* **FASTENERS**

one of the



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380 Donald St.
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**METAL AND WOOD
FASTENING DEVICES**
301 King St. East
Toronto, Ont.

For further information mark No. 39 on Readers' Service Card

NEW COLLINS SSB MOBILE RADIO

Collins 32MS-1A Single Sideband Transceiver delivers mobile communication dependability you can count on. This versatile unit is at home on land in jeep, truck, car and as a fixed station at your headquarters . . . or in marine or aircraft installations. ■ By adopting the 32MS-1A as basic equipment for your network, you eliminate the need to stock more than one set of spare parts. Maintenance and training problems are reduced, too. ■ The 32MS-1A system provides your operator with a choice of either SSB or compatible AM operation on any of the four preset frequencies in the 1.6-15.0 mc range. And . . . all functions, including channel selection, are controlled by pushbuttons for ease of operation even by your unskilled personnel. ■ A power output of 100 watts PEP (50 watts AM) can be obtained from plug-in power supplies of either 12 v dc, 28 v dc or 115-230 v ac, 50-400 cps single phase power sources. ■ Get complete details about the 32MS-1A from your authorized Collins dealer, or write Collins Radio Company of Canada, Ltd., 11 Bermondsey Road, Toronto 16, Ontario.



Eliminate chart analysis with

DIGITAL READOUT RECORDING



0 2 3 7 6

0-50
MICROVOLTS

0 0 5 2 9

50-75
MICROVOLTS

0 0 7 4 3

75-100
MICROVOLTS

0 1 7 9 0

100-200
MICROVOLTS

0 3 9 3 6

OVER 200
MICROVOLTS



The Digital Recorder is available in standard five- or ten-counter versions (others to special order) for standard rack mounting, in moisture- and dust-proof CEMA 12 housings, or in wood cases for bench or portable use. Wide ranges of sensitivity, scales and value group arrangement are feasible.

Your inquiries are invited.

From Bach-Simpson Limited comes the ideal "survey" recorder—presenting its story as quickly as the counters can be read—eliminating time-consuming chart or tape analysis. Total survey time can be hours or weeks, and the need for skilled and constant maintenance is gone along with the tapes, pens and ink. Anyone can read it.

Designed to record any function (e.g. Voltage, temperature, field strength) which, with the use of a suitable transducer, can be displayed on a panel meter, it operates by sampling the function value at preset intervals (from 1 sec. to 20 min.). Counter readings record the number of times this value has been found to be in each "value group" or subdivision of the function's range. With a sampling rate compatible with the rate of change of the function, these readings, multiplied by sampling interval, yield the total time that the value of the function fell within each value group.

As a result, where a statistical record of function behaviour rather than a complex minute-by-minute tracing of its variations is required, the Digital Recorder is the simple, economical answer.

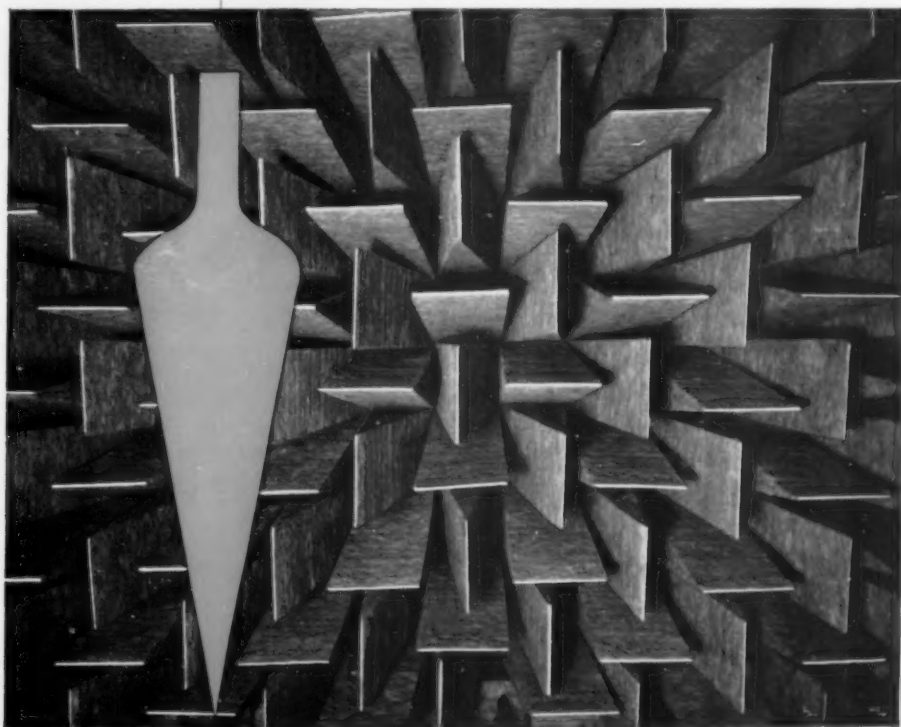


1255 Brydges St., London

IN SOUND, TO PLUMB NEW DEPTHS

Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

■ RESEARCH AND DEVELOPMENT LABORATORIES



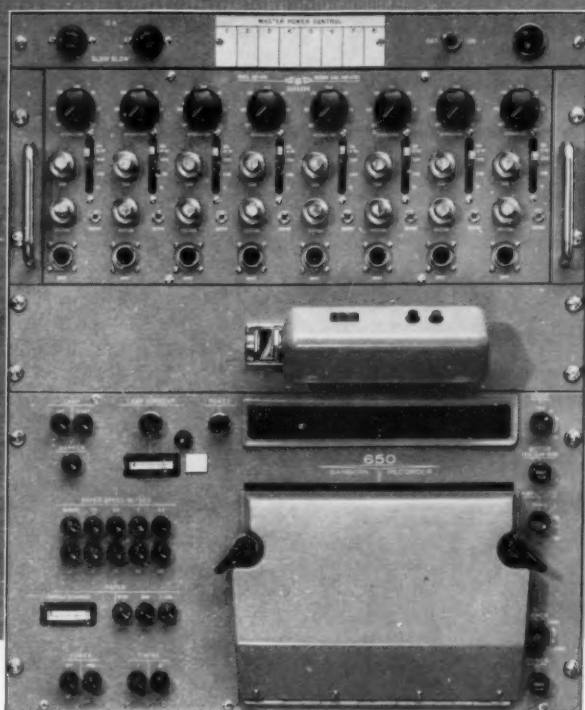
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COMPANY LIMITED

SERVES YOU BEST

For further information mark No. 31 on Readers' Service Card

6660-26

DC to 5000 cycles
over an amplitude
of 4" peak to peak



NEW SANBORN "650" SYSTEM

OFFERS DIRECT READOUT, 8 TO 24 CHANNELS, ALL SOLID STATE CIRCUITS, FOR RACK MOUNTING OR INDIVIDUAL CASES.

SENSITIVITY 20 mv input gives 8" deflection; 12 attenuator steps to X5000, smooth gain control.

INPUT RESISTANCE 100,000 ohms all ranges, floating and guarded; DC source resistance must be kept below 1000 ohms on mv ranges only.

COMMON MODE PERFORMANCE Rejection at least 140 db at DC, tolerance to ± 500 volts, max.

GAIN STABILITY Better than 1% to 50° C. and for line voltage variation from 103 to 127 volts.

LINEARITY 1½% of full scale (8 in.)

NOISE 0.02" peak-to-peak, max.

MONITOR OUTPUT On front panel; provides ± 1 v full scale across 100,000 ohm load

POWER REQUIREMENTS 103-127 volts, 60 cycle AC; 625 watts



Here's the *one* system that lets you record inputs from DC to 5 KC within 3 db at 4" peak-to-peak amplitudes, without changing galvanometers. The "650" system consists of an 8-channel medium gain, general purpose amplifier unit driving a high speed, high resolution optical oscillographic recorder. It can be easily built into your system, packaged in a mobile cabinet or housed in individual cases. The single-chassis, 7" high amplifier module has 8 separate channels, *complete from floating and guarded inputs to galvanometer outputs*; each channel comprises a front end modulator and input transformer, carrier amplifier, demodulator, filter and driver amplifier. Power Supply and Master Oscillator Power Amplifier are built-in. All amplifier elements are plug-in transistorized units for easy servicing.

Immediately readable recordings are made on 8" wide daylight-loading ultra-violet-sensitive charts which require no chemical development. Features of the 12¼" high recorder unit include 9 electrically controlled chart speeds from ¼" to 100"/sec; calibrated monitoring screen; automatic trace identification and timing lines at 0.01 or 0.1 sec. intervals; amplitude lines spaced 0.1" apart which can be blanked from ¼, ½, ¾ or all of chart. Recorder is available with an 8-, 16- or 24-channel galvanometer block which is then equipped with the number of galvanometer elements desired by the customer. Both the Recorder and Amplifier are also available as individual units for use with other equipment.

Contact your Sanborn Sales-Engineering Representative for complete specifications and applications engineering assistance. Offices throughout the U. S., Canada and foreign countries.

SANBORN COMPANY
INDUSTRIAL DIVISION

176 Wyman St., Waltham 54, Massachusetts

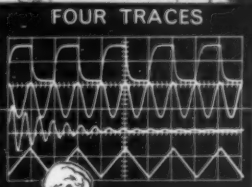
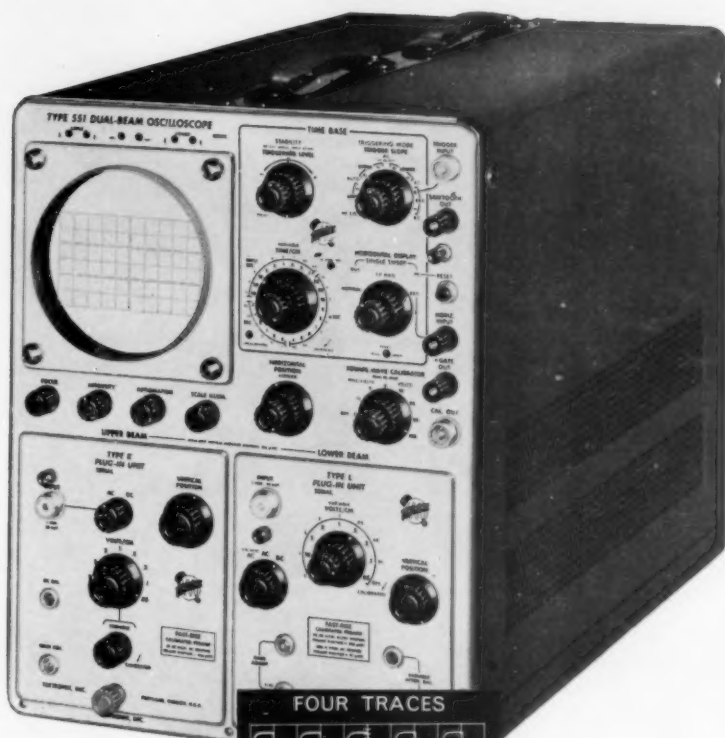
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CANADIAN ELECTRONICS ENGINEERING AUGUST 1961

DUAL-BEAM OSCILLOSCOPE

DC-TO-25 MC, 14-NANOSECOND RISETIME WITH FAST-RISE PLUG-IN UNITS

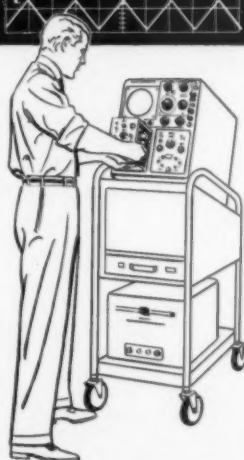
TYPE 551



You can compare waveforms simply, conveniently, reliably with a Tektronix Type 551 Dual-Beam Oscilloscope.

You can display up to four traces at once—with Tektronix dual-trace units in both channels. Or, you can interchange any combination of 16 other "letter-series" plug-in units for such applications as dual-beam pulse sampling . . . transistor-risetime testing . . . semiconductor-diode-recovery-time studies . . . strain gage and other transducer measurements . . . as well as multiple-trace work in other specialized displays or general-purpose laboratory experiments.

If you need a fast-rise, dual-beam oscilloscope—offering signal-handling ease and dependability in dc-to-25 mc waveform-comparison analyses—consider a Tektronix Type 551.



CHARACTERISTICS

Common X-Independent Y Deflection. Adaptable Vertical System—Accepts interchangeable plug-in preamplifiers. **Versatile Sweep Features**—Wide range from 0.1 $\mu\text{sec/cm}$ to 5 sec/cm in 24 calibrated sweep rates, continuously variable uncalibrated to 12 sec/cm . 5x magnifier increases calibrated sweep time to 20 nsec/cm . Single sweep facilitates recording one-shot phenomena. **Complete Triggering Facilities**—Amplitude-level (manual) selection or fully automatic control. **High Writing Rate**—10-KV accelerating potential provides bright traces at low repetition rates. 4 by 10 centimeter display for each beam, with 2 centimeter overlap. **Precise Amplitude Calibrator**—With 18 square-wave voltages (from 0.2 mv to 100 v peak-to-peak) available at the front panel.

Type 551 (without preamplifiers) \$1800

Includes Indicator Unit, Power Unit, 4 Probes, 8 other accessories.
price f.o.b. factory

For a demonstration of the capabilities of a Type 551 in your own waveform-comparison analyses, call your Tektronix Field Engineer.

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**CANADIAN
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3 Finch Ave. East
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Phone: Toronto, BAldwin 5-1138

MONTREAL FIELD OFFICE
3285 Cavendish Blvd., Suite 160
Montreal, Quebec
Phone: HUnter 9-9707

For further information mark No. 42 on Readers' Service Card

What Would Americans Do?

An editorial from The OTTAWA JOURNAL, July 4, 1961

If three out of every four magazines read by Americans were imported from Canada; If in a single year Americans read 147,000,000 copies of Canadian magazines compared to 45,000,000 copies of their own magazines;

If distribution of 40 per cent of all magazines sold on U.S. newsstands was controlled by two Canadian companies;

If two Canadian-owned and controlled magazines publishing so-called "U.S. editions" in the U.S. were taking between them 40 per cent of all U.S. consumer magazine advertising;

If these two Canadian-owned "U.S. editions" in the U.S. were using second-hand editorial material from a Canadian parent editorial pool to provide unfair competition for U.S. magazines, threatening them with extinction;

If these Canadian-owned magazines with their "U.S. editions" were reaping profits not only greater than the profits of American magazines but greater even than the profits of their parent Canadian companies—in such circumstances, WHAT WOULD AMERICANS DO?

We think we know what they would do. And we think also that they would do it without asking or waiting for permission from Canada.

And the Americans would be right.

For if a nation be unwilling to safeguard its own communications, or be afraid to safeguard them, it is hardly fit to be a nation.

The report of the Royal Commission on Publications went out of its way to try to explain this to Americans—to appeal to their sense of what was just and fair. And if ever a report was free of anti-Americanism, it was this report.

* * *

Some Canadian editors—happily not a majority—have been saying that the recommendations of the Royal Commission would interfere with the "free flow of ideas."

The only comment that can be made on this—made perhaps more in the interest of charity than of truth—is that editors speaking such nonsense cannot have read the report.

For not a line, not a word, not a syllable in the report recommended or suggested anything which in any way whatsoever would interfere with the editorial content, the views or the ideas of any American

magazine entering Canada.

To speak of "a sort of censorship," as one Toronto newspaper has spoken of it, is either to betray gross stupidity, or to willingly do violence to language.

Not an editorial line nor word in any American magazine entering Canada would be censored or taxed or in any way interfered with. *Time* magazine as it is published in the U.S., *Reader's Digest* as it is published in the U.S., the *Saturday Evening Post* as it is published in the U.S., the *Atlantic Monthly*, *Harpers*, all U.S. magazines as they are published in the U.S., would enter Canada as they enter Canada now. No interference whatsoever would there be with readers' preference.

Only when American magazines changed from what they were in their own country and made themselves, for extra profit, into carriers or packaging for advertising directed to Canadian consumers, would they be touched.

Where the censorship there? Where the tax on ideas? Where the interference with the "free flow of information"?

And speaking of the "free flow of information," what about the free flow of Canadian information—the free flow of information east and west in Canada; between Canadian provinces? Is that to be dammed, stopped, so that Mr. HENRY LUCE's vast magazine empire may reap greater profits from Canadian advertising?

* * *

Time magazine, cries a *Time* appeal to Canadians, should not be driven out of Canada.

What would be driven out of Canada? *Time* (Canada), a split-run device to garner Canadian advertising at the expense of Canadian periodicals, at the expense of Canada's own communications, never was in Canada.

Time (Canada) was owned in the U.S. *Time* (Canada's) so-called Canadian news was edited and processed in New York. *Time* (Canada) was printed in Chicago. *Time* (Canada) was mailed to its Canadian subscribers from Chicago—its postage paid to the U.S. post office. *Time* (Canada) had no physical assets in Canada—nothing but what it called its publishing office in Montreal (actually the office of its distinguished counsel), plus an office in Toronto from which its amiable Mr. LARRY

LAYBOURNE sold Canadian advertising.

That was—and is—*Time* in Canada; the very refinement of a split-run, a pure unadulterated device to make substantial profits for Mr. HENRY LUCE out of Canadian advertising (it should be said for Mr. LUCE, however, that he publicly repudiated the claim of his subordinates that *Time* (Canada) was a Canadian magazine).

* * *

THE JOURNAL must say that for *Reader's Digest* it has a degree of sympathy; it has never claimed that it was a "Canadian magazine," it did in some measure operate in Canada, employing Canadians and Canadian materials, and it is in a sense a magazine of universal appeal, though why, God only knows. If, therefore, some sort of exception could be made of it, perhaps not many Canadians would mind. The question is how to do it.

* * *

Nevertheless, if a choice has to be made between the continued existence in Canada of *Time* (Canada) and *Reader's Digest* and the existence of our own Canadian publications—our own Canadian communications—then surely there can be no doubt nor question over what that choice should be.

If we are unwilling or afraid to make the choice, let ourselves be bamboozled by ignorant talk about "press freedom" and "censorship," then for Heaven's sake and our own integrity let's stop talking about "Canadianism."

THE REPORT OF THE ROYAL COMMISSION ON PUBLICATIONS



to the Government of Canada is important to the people of Canada, it is important also to those in the United States desirous of understanding their neighbours.

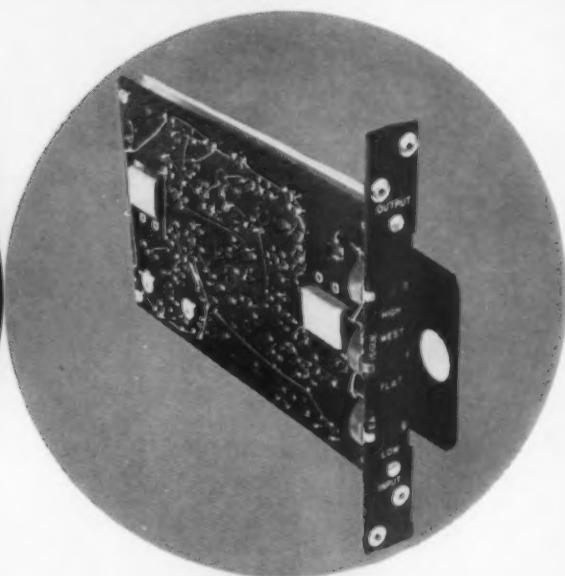
Complete copies of the 259 page report are available from the Queen's Printer, Ottawa, Canada. Price \$3.00.

This advertisement sponsored by

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81A
EXCHANGE TRUNK
CARRIER



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COMPLETELY TRANSISTORIZED
designed for
SIMPLE MAINTENANCE
•
RELIABILITY

GROWTH

The Lenkurt Type 81A Exchange Trunk Carrier has been designed for growth. It readily lends itself to changing conditions and increased capacity requirements with a minimum of trouble and expense. Easily replaced plug-in circuits and the recommended once a year routine adjustment attest to its simplicity of maintenance; whereas stitched wiring and complete transistorization ensure the maximum in reliability. For further information contact Lenkurt Electric Co. of Canada, Ltd., 7018 Lougheed Highway, North Burnaby, P.O., Vancouver, B.C., or any of the district offices in major cities across Canada.

LENKURT ELECTRIC

SUBSIDIARY OF
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a pleasure
to measure
with these...



5512A, 300 KC



5532A, 1.2 MC

4 NEW SOLID STATE

Measure frequency, period, ratio, quickly, accurately
continuous display, no "blinking"...0.1 volt sensitivity
...Unique low frequency accuracy...Operation—20° to

All the advantages of solid-state design are now yours in these new Φ solid state counters—offered at prices comparable to those of today's vacuum tube counters. And you get the *plus* advantages of greater readability, faster measurements, easier routine maintenance, rack-and-stack convenience of the new Φ universal module instrument cabinets.

Offered in four models, these new counters have maximum counting rates of 300 KC or 1.2 MC, with a choice of Nixie or columnar readouts. The high-intensity neon readouts are stacked in compact columns for faster, easier reading. On the in-line readouts, Φ -pioneered standard incorporation of the new long-life, wide-viewing Nixies gives you many extra hours of lamp life and heretofore unknown readability even at extreme angles. Polarized screen provides maximum readout brilliance with freedom from reflections.

A unique display storage feature of these new counters produces a continuous visual readout of the most recent measurement, even while the instrument is making a new measurement. Only if the new count differs from the previous count will the display change, in which case it will shift directly to the new reading. The fatigue and error possibility of a "blinking" display is eliminated. The storage feature may be disabled with a rear panel switch.

The counter's "inactive time" (when not making a new measurement) is independent of gate time and adjustable from 0.2 to 5.0 seconds, thus permitting a higher sampling rate.

Counter	Max. Counting Rate	Registration	Period	
			Range	Accuracy
5212A	300 KC	5 digits columnar	2 cps to 10 KC in single period; up to 300 KC in multiple period average	$\pm 10 \mu s \pm$ time base accuracy \pm trigger error/periods averaged
5512A	300 KC	5 digits Nixie		
5232A	1.2 MC	6 digits columnar	2 cps to 10 KC in single period; up to 1 MC in multiple period average	$\pm 1 \mu s \pm$ time base accuracy \pm trigger error/periods averaged
5532A	1.2 MC	6 digits Nixie		

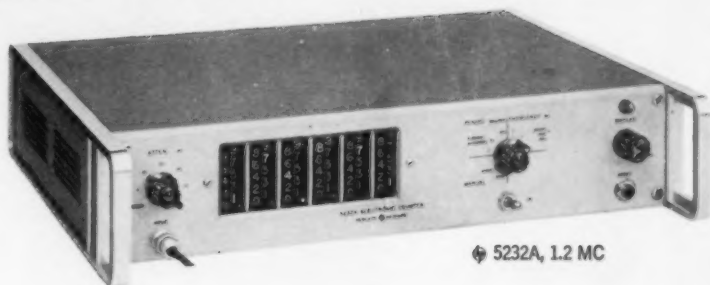
High sensitivity permits low level measurement without accessories, and multiple period average measurement (to 100,000 periods) gives higher ac-



Note clean, compact, easy-to-service physical arrangement of new Φ solid-state counters.



5212A, 300 KC



5232A, 1.2 MC



COUNTERS!

Compact, easy-to-use instruments provide
Solid-state dependability...Higher sampling rate
65°C...Prices comparable to vacuum tube counters!

Measurement		Frequency Measurement				Ratio Measurement			Price
Reads in	Periods Averaged	Range	Accuracy	Reads In	Gate Time	Reads	Range	Accuracy	
Milli-seconds with positioned decimal	1, 10, 10 ² , 10 ³ , 10 ⁴ , 10 ⁵	2 cps to 300 KC	± 1 count ± time base accuracy	KC with positioned decimal	10, 1, 0.1, 0.01 sec.	(f ₁ /f ₂) x period multiplier	f ₁ : 100 cps to 300 KC (1 v rms into 1,000 ohms) f ₂ : same as period	± 1 count of f ₁ ± trigger error of f ₂	\$ 975.00
Milli-seconds or Microseconds with positioned decimal		2 cps to 1.2 MC					f ₁ : 100 cps to 1.2 MC (1 v rms into 500 ohms) f ₂ : same as period		1,175.00
									1,300.00
									1,550.00

accuracy in lower frequency ranges, even for noisy signals. Self-check is provided for both frequency and period measurement modes.

Only 3½" high, these counters are housed in the new modular cabinets ideal for both bench use and easy rack mounting. Routine maintenance is simple with snap-out decade/readout units and circuit cards. Readout drive directly from photoconductors eliminates a complete stage of complex circuitry, to effect genuine cost and reliability advantages. Compact design and construction and servicing ease are illustrated at the left.

Solid state design and construction gives you the advantages of low heat dissipation with minor heating effect on adjacent equipment, fast warm-up, low power consumption and new standards of reliability.

The new counters include a four-line BCD code output. This output, with assigned weights of 1-2-2-4, is available for systems use or to operate devices such as the 562A Digital Recorder. Front panel controls include Input Attenuation, Display, Reset and Function.

Call or write your representative or call us today for information and a demonstration!

Data subject to change without notice. Prices f.o.b. factory.



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Palo Alto, California, U.S.A.
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CANADIAN ELECTRONICS ENGINEERING AUGUST 1961

TUNG-SOL HIGH PERFORMANCE

GENERAL PURPOSE
MINIATURE COMPUTER TRIODE

7719

Directly replaces parallel-connected 5965 and 7062 twin-triodes while providing these added advantages for designers of computer circuits:

- Higher transconductance
- Very sharp cut-off
- Much higher plate dissipation
- Linear transfer characteristics
- Very high perveance
- Improved reliability

The Tung-Sol 9-pin miniature 7719 general purpose triode is the latest addition to the Tung-Sol family of top-rated, high-reliability tubes for computer service. Rated at 6 watts plate dissipation, the 7719 incorporates many design and construction features which assure computer users the maximum number of hours of trouble-free peak performance.

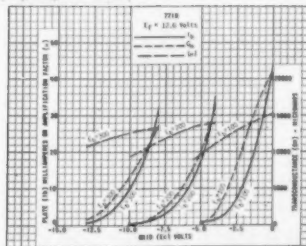
CHECK THESE ADDITIONAL BENEFITS:

- Freedom from cathode interface and reduced electrical leakage . . . Achieved through use of a passive cathode alloy and lower heater power per unit area.
- Minimization of grid emission . . . The 7719 is designed with heavy grid support wire and a double connection to the grid for cooler operation allowing use of 1 megohm grid circuit resistance.
- High stability . . . Use of heavier stock plate material assures more even distribution of heat and lower plate temperature. Cool operation further guaranteed by cool cathode and low bulb temperature (175°C at 6 watt dissipation).
- Very little "island" formation . . . Optimized geometry minimizes island formation thereby providing sharp cut-off, linearity and high perveance.

Typical applications of the 7719 are found in totem pole amplifiers to drive function-generating potentiometers, cathode followers, and multivibrators. Full technical details on the 7719 are available immediately on request.

RATINGS

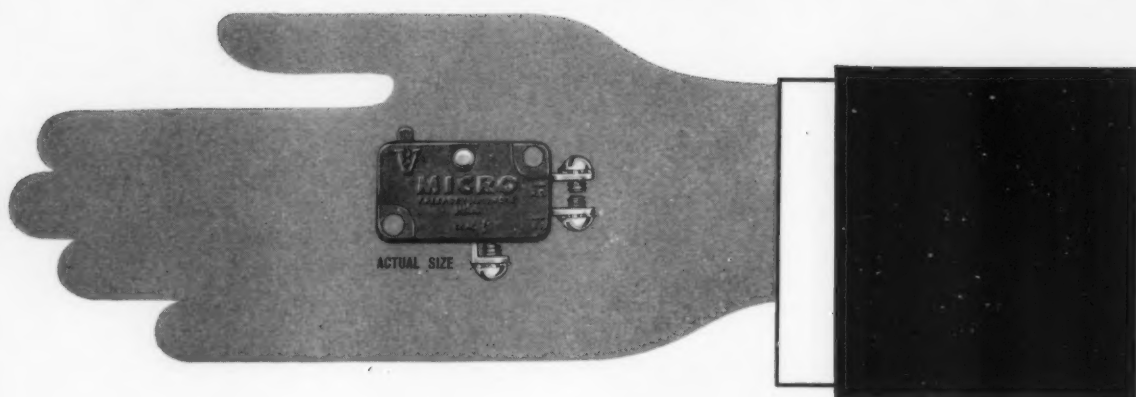
Heater Voltage (Series)	12.6 ± 0.6	Volts
Heater Voltage (Parallel)	6.3 ± 0.3	Volts
Maximum Plate Voltage	380	Volts
Maximum Plate Dissipation	6.0	Watts
Maximum DC Cathode Current	40	Ma.
Maximum Heater-Cathode Voltage:		
Heater Negative With Respect to Cathode		
Total DC and Peak	900	Volts
Heater Positive With Respect to Cathode		
DC	100	Volts
Total DC and Peak	900	Volts
Maximum Bulb Temperature	175	°C



 **TUNG-SOL®**

Technical assistance is available through: Atlanta, Ga.; Columbus, Ohio; Culver City, Calif.; Dallas, Texas; Denver, Colo.; Detroit, Mich.; Irvington, N. J.; Melrose Park, Ill.; Newark, N. J.; Philadelphia, Pa.; Seattle, Wash. In CANADA: Abbey Electronics, Toronto, Ont.

For further information mark No. 43 on Readers' Service Card



Your choice of
many auxiliary actuator designs



Single-pole double-throw
(With quick-connect terminals)



Single-pole double-throw



Single-pole double-throw
(Extra-long life, mushroom head plunger)

MINIATURE BUT MIGHTY

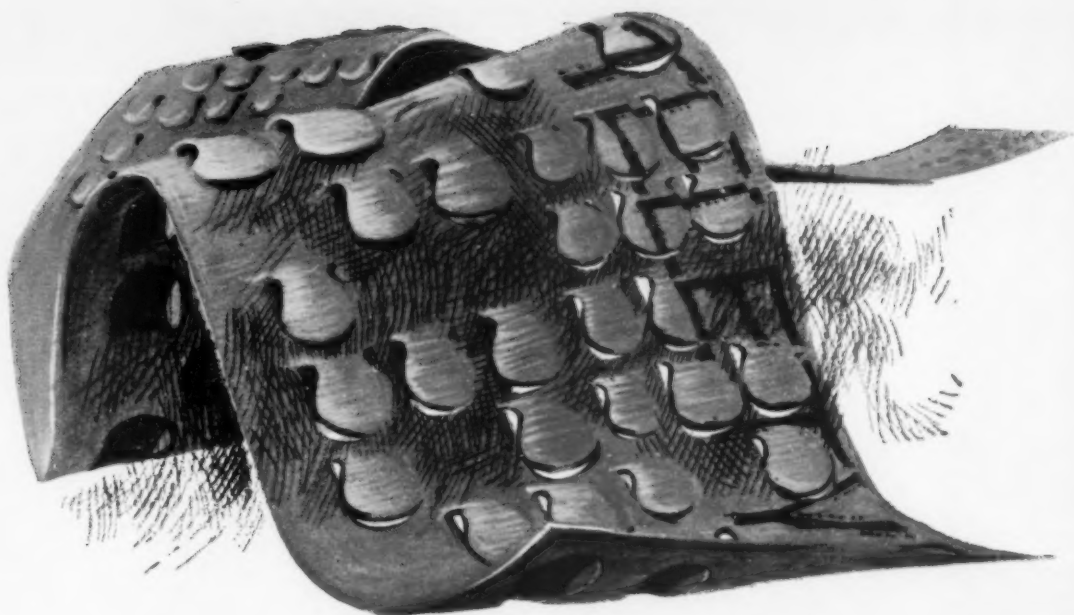
...WITH NEW, HIGHER CAPACITIES! This versatile series of basic switches combines miniature size with new, higher electrical capacities. Switch cases and plungers are available in different plastic materials to meet varying requirements. Special high-temperature versions with synthetic mica cases withstand temperatures up to 600°F. Contact arrangements include double-throw, normally-open or normally-closed, with a choice of terminals. Models are available which conform to applicable requirements of Military Specification MIL-S-6743. "V3" Series basic switches are especially adaptable to multiple cam-operated gang-mounted systems and are also used as switching elements in many of our enclosures and assemblies. Further information in Catalog 63. Ask your nearby Honeywell office or write Honeywell Controls Limited, *Precision Components Division*, Toronto 17, Ontario.



Honeywell
MICRO SWITCH Precision Switches

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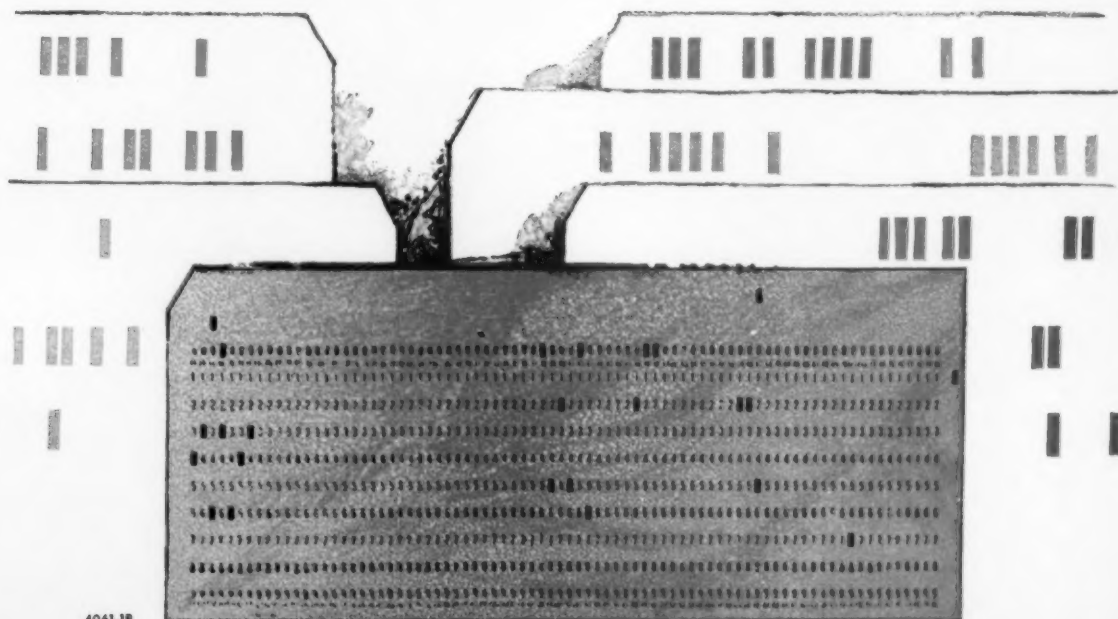
CANADIAN ELECTRONICS ENGINEERING AUGUST 1961



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A modern Data Processing Center... continuous representation in 57 locations across Canada... linked by a coast-to-coast Teletype network that maintains instant inter-communication. The speed and accuracy of these business tools improve our productivity... help us provide a vital national electrical service at low cost for our customers. For communications equipment, wires and cables, electrical supplies and apparatus, call

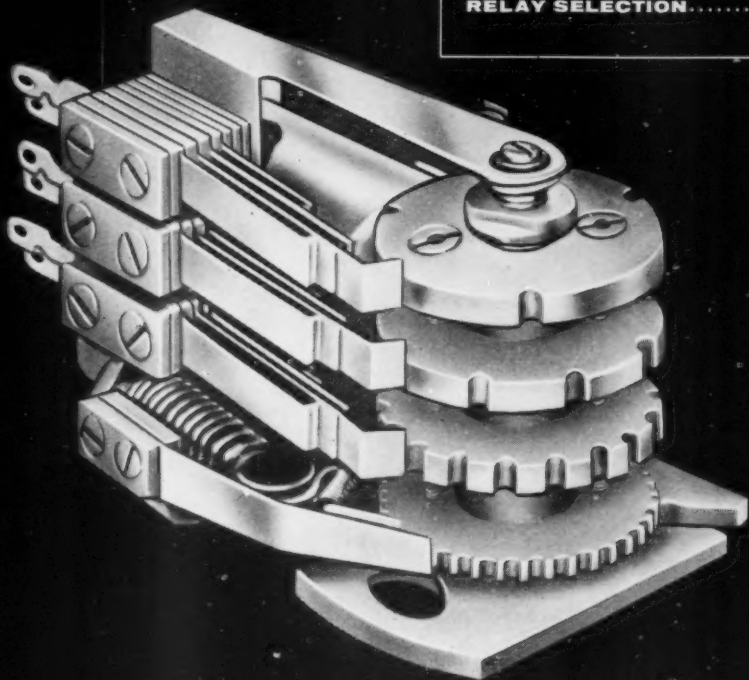
Northern Electric
COMPANY LIMITED



4061-1R

For further information mark No. 32 on Readers' Service Card

**CHARACTERISTICS THAT DETERMINE
RELAY SELECTION..... NO. 10**



Series OCS—up to 6 cams, 32 or 36 intervals.

for use under extreme shock conditions

Helpful selection data Series OCS

CAPACITY

Up to 6 cams, 32 or 36 steps per revolution.

OPERATION

Impulse-controlled or self-interrupted.

SPEED OF OPERATION

Self-interrupted 65 steps per second, impulse-controlled to 30 steps per second.

VIBRATION

Withstands to 10.5 G.

SHOCK AND ACCELERATION

To 25 G.

AMBIENT TEMPERATURE RANGE

-55° C. to +85° C.

The relay that will give reliable service under conditions of extreme shock, vibration or temperature variation, is the rugged Series OCS by Automatic Electric. The OCS replaces whole banks of other relays, and combinations of relays and stepping switches. It can be used for cam-switching—for alternate on-off operations—or as an accurate high-speed stepping switch for a variety of applications. It can be driven self-interrupted to produce a time cycle or for "homing"—or adapted to meet military

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Silvered mica disc

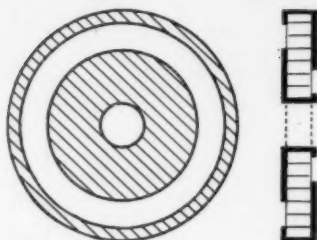


Figure 1

Silvered mica stack



Figure 2

New button mica capacitors feature good UHF performance up to 125C

G. C. ROBINSON*

Hermetically sealed button mica capacitors, capable of operating from -55 to $+125$ deg. C, have been developed under an ECRDC contract in both feed-through and stand-off versions. The units feature good UHF performance and exceed the environmental requirements of MIL-C-10950B.

Button mica capacitors were first developed by the Erie Resistor Corp., Erie, Pa., in 1942. They are compact, rugged units which, due to their special design, are particularly suited to VHF and UHF applications.

The original design used a wax seal for moisture protection. Later a resin seal was developed. This enabled the capacitors to meet the requirements of specification MIL-C-10950B for the range of -55 to $+85$ C.

However, the need arose for a hermetically sealed capacitor which would operate over the temperature range of -55 to $+125$ C. The development of such a capacitor was accomplished by Erie Resistor of Canada Ltd., working under a contract placed by the Electronic Component Research and Development Committee. The end result was the glass-metal seal construction described below, in both feed-through and stand-off versions.

Construction

The basic unit of the capacitor is the silvered mica disc shown in Fig. 1. The electrodes are extended over the edges of the mica disc so that when connections are made to the outer edge of the disc and the edge of the centre hole, a capacitance of approximately 50 pf is obtained. By stacking several silvered discs as shown in Fig. 2, the individual disc capacitances are connected

in parallel. As many as 24 discs can be assembled in the completed capacitors, providing capacitance values up to 1200 pf. The use of heavy terminals together with a shell design keeps the inductance to a minimum and permits the current to fan out in a 360-degree pattern, making the shortest possible path to ground. These features provide an extremely good UHF capacitor.

Referring to Fig. 3a for the feed-through design, the silvered mica stack A is compressed between the glass-metal seals B and C when the edge D of the silver plated brass shell E is mechanically rolled onto the upper glass-metal seal. The unit is vacuum impregnated and sealed with tin-lead solder as indicated.

In the stand-off version, as shown in Fig. 3b, the silvered mica stack A is rivetted to the combined glass-metal seal and terminal B. This assembly is compressed in the stand-off style shell C by mechanically rolling the shell edge D. Tin-lead solder is applied around the rolled edge as indicated and, after impregnation, the end of the tubular terminal is crimped and sealed with silver solder.

Electrical characteristics

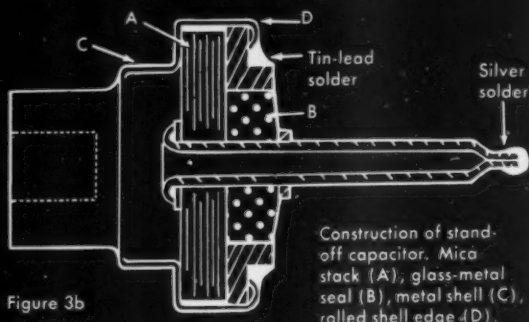
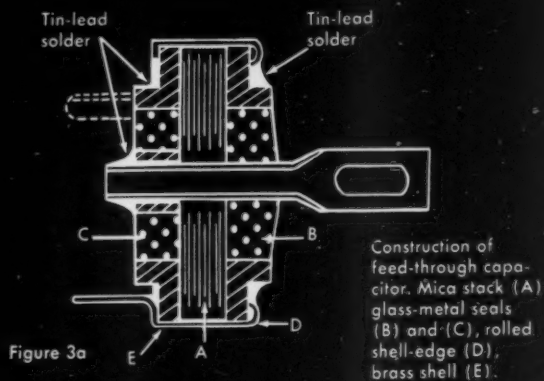
Capacitance values from 15 to 1200 pf are available with tolerances up to $\pm 2\%$ or ± 1 pf whichever is the greater. The working voltage is 500 volts dc and the units withstand a 1250 volts dc dielectric strength test.

Independent tests by the Canadian Arsenal Laboratories and CAMESA on 1000 pf capacitors gave quality factor ($1/\omega CR$) values of 5000 for the stand-off type and in excess of 2000 for the feed-through.

Measurements of insulation resistance were made at 250 volts at various temperatures. These gave values in excess of 10^{12} ohms at 85C; not less than 10^{11} ohms at 125C; and about 5×10^{10} ohms at 150C.

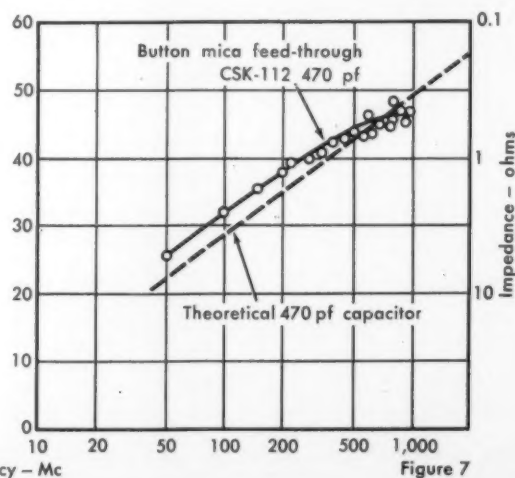
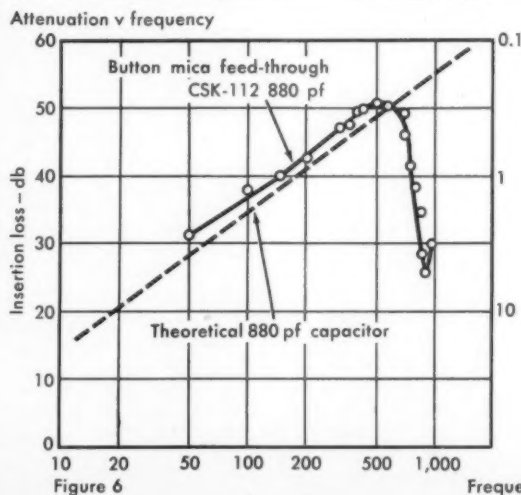
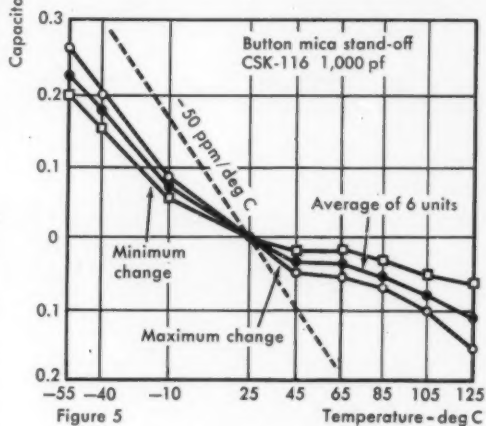
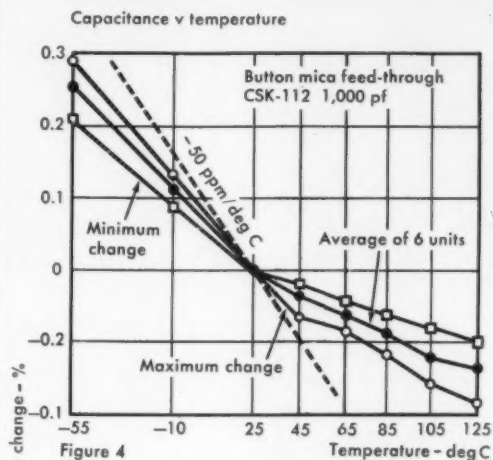
Throughout the temperature range from -55 to $+125$ C the temperature co-efficient of capacitance lies between 0 and -50 parts per million per degree C, as shown

*Erie Resistor of Canada Ltd., Trenton, Ont.



in Figs. 4 & 5: Capacitance drift does not exceed 0.03%.

Insertion loss measurements at frequencies up to 1000 Mc were made on feed-through capacitors of various values. The results are shown in Figs. 6-9. For values of 470 pf and less the insertion loss is very close to that of an ideal capacitor throughout the complete frequency range. However, Fig. 6 for an 880 pf capacitor shows this relationship holds good only up to about 500 Mc. This is due to the increased effect of parallel reso-



nances associated with the increased number of mica sheets.

Environmental tests

The initial electrical characteristics are essentially unaltered after the temperature and immersion cycling, moisture resistance and 125C life tests of MIL-C-10950B.

The capacitors have also been subjected to the more rigorous temperature and immersion cycling, and moisture resistance tests of the Target Specification. Here the temperature cycle, +25C to -55C to +25C to +125C to +25C was repeated five times and then followed by two immersion cycles — one hour in boiling tap water followed by one hour in tap water at 20C. The MIL-C-10950B cycling involves two immersion cycles as follows — 15 minutes in tap water at 65C and 15 minutes in tap water at 25C. The capacitors were unaffected by the more stringent test.

The target specification moisture resistance test was that specified in Standardization Bulletin SB14, Appendix 1. Briefly, the test consists of two weekly cycles, each consisting of four daily cycles followed by a 72-hour steady state period. During each daily cycle the temperature is varied from +30C to +65C to +30C to -10C to +30C, the relative humidity being maintained at 90 to 95%, except when the temperature falls below 30C, when it is uncontrolled. During the 72-hour steady state period, the temperature is maintained at 30C and the relative humidity at 90 to 95%. A polarizing voltage of 100 volts is applied to the capacitors under test throughout the whole of the two weeks.

Results from this test indicated that provided conditions were carefully controlled, in particular that moisture was not allowed to drop onto the units and variations in the steady state temperature were minimized, then metal migration did not occur. However, when the above precautions were not taken, silver migration occasionally occurred across the glass surface between the silver plated electrodes. This provided a low resistance path which persisted even when the units are dried.

Thus, although the silver plated capacitors pass the target specification moisture resistance test, they appear to be borderline. The table below summarizes the results of these tests.

Complete freedom from surface conduction was achieved by gold plating the glass-metal seals and brass shells. This was confirmed by prolonging the steady state condition of the moisture resistance test (normally the most severe part) for 17 days in an atmosphere fully saturated with water vapour at 40C.

Conclusions

Hermetically sealed button style mica capacitors which exceed the requirements of MIL-C-10950B and the more stringent target specification, have been developed. The two types, stand-off and feed-through, have excellent high frequency characteristics. They are small and rugged and can be readily and securely mounted to a chassis.

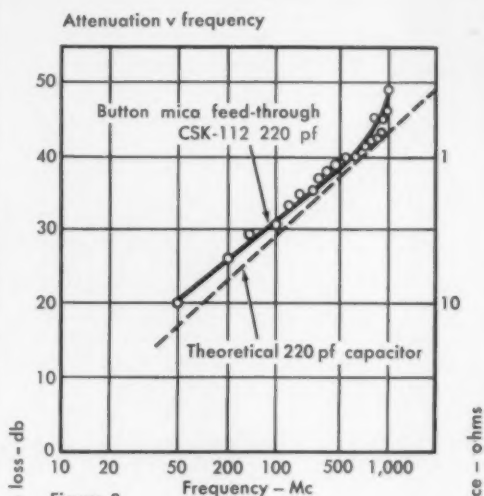


Figure 8

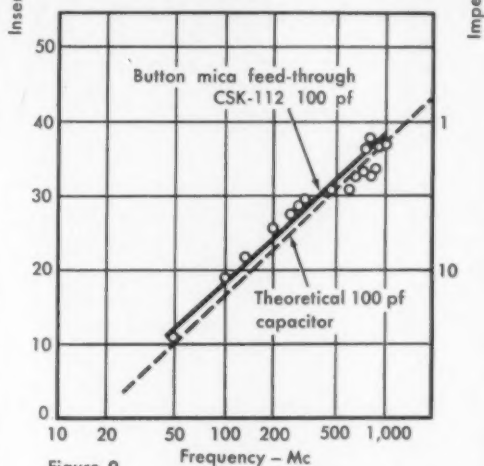


Figure 9

Freedom from surface conduction when polarized in saturated atmospheres has been achieved by gold plating the metal parts of the capacitors. However, the standard silver plated units will suffice under all but the most stringent conditions.

These capacitors have been supplied and are currently available for military and other equipments. END

Test agency	Specification	Test conditions	Capacitor type	Insulation resistance	Quality factor
CAMESA	MIL-C-10950B	700 vdc at 125C for 1,000 hours	Feed-through, silver plated	100 Gigohms	>2200
CAMESA	MIL-STD-202A Method 106A	Moisture resistance	Feed-through, silver plated	200 Gigohms	<1900
Canadian Arsenals	MIL-STD-202A Method 106A	Moisture resistance with 100 vdc	Stand-off, silver plated	100 Gigohms	5000

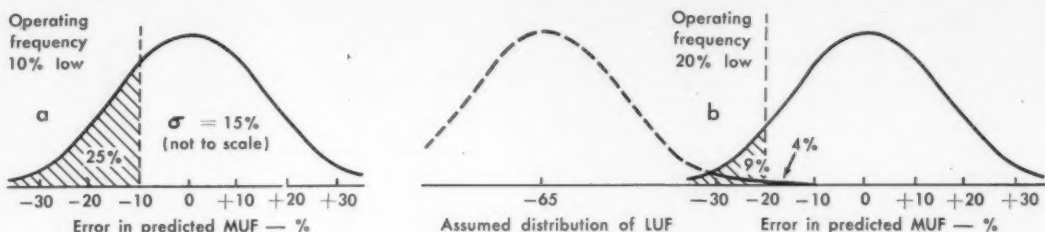


Fig. 1. Effect of MUF and LUF distribution on an HF communication system for different operating frequencies.

Oblique ionospheric sounding improves communication system performance

HAROLD PRICE, EDITOR

Accurate prediction of the best operating frequency for HF communication systems has always been a problem. Philips Electronics Industries have developed and built oblique ionospheric sounders that can provide information to the HF communications user on which to base his choice of frequency.

High frequency communication systems have rarely achieved transmission efficiencies of more than about 87%. This is because of the difficulty in forecasting accurately the best frequency to use at any given time for each particular path. Now oblique ionospheric sounding equipment can provide continuous information on path characteristics, permitting efficiencies to be increased to their optimum value.

The normal HF communications user may be allocated a number of frequencies in the band from about 3 to 30 Mc. Predictions of the maximum usable frequency (MUF) at specified times for certain prescribed routes are issued periodically by authorities such as the Defence Research Telecommunications Establishment, Shirley Bay, Ontario; the Radio Research Station of the Department of Scientific and Industrial Research, Slough, England; and the National Bureau of Standards, Washington, D.C. The predicted MUF values are calculated from data obtained from vertical sounding measurements. The user selects his transmitting frequency on the basis of these predictions, combined with operational experience on the path concerned.

Experience shows that there is a wide tolerance on the predicted values, so it is usual to operate somewhat on the low side of the predicted MUF. However, communication still becomes impossible when the actual MUF falls below the operating frequency. Under other conditions the MUF becomes so high that path attenuation at the oper-

ating frequency severely limits the usefulness of the circuit.

The staff of the DSIR Radio Research Station have published a tabulation of the errors in forecasting the critical frequency of the F2 layer for a number of ionospheric observatories during the years 1949-57¹. It was concluded that 15% is a typical value for the standard deviation of the error at a location for which adequate ionospheric data is available. Standard deviations of 6%, 10% and 18% have been reported by other authorities.^{2, 3}

Suppose an operator selects an operating frequency 10% lower than the predicted MUF, and the MUF distribution is assumed to be as shown in Fig. 1. Then the actual MUF will be less than the operating frequency and communication will not be possible for about 25% of the time (Fig. 1a). Similarly, if the operating frequency is reduced to 20% below the predicted MUF to allow for ionospheric irregularities and turbulence, the actual MUF will be less than the operating frequency for about 9% of the time (Fig. 1b).

Path attenuation

However, if the operating frequency is considerably below the actual MUF, severe path attenuation will occur, since the path attenuation is approximately inversely proportional to the square of the operating frequency. Path attenuation thus sets a limit to the lowest usable frequency (LUF). Little statistical information is available on the LUF since it also varies with transmitter power, antenna gains and receiver sensitivity.

If the median LUF is assumed to be about one-third of the predicted MUF and a similar probability distribution is assumed, then if the operating frequency is 20% lower than the predicted MUF the circuit will be unusable due to severe path attenuation for 4% of the time, as shown in Fig. 1b. The unusable time will therefore total some 13% (9% + 4%).

Thus, for operating frequencies between 10% and 20% below the predicted MUF, communication will not be possible for some 13% to 25% of the time, until sufficient knowledge is gained of the operating conditions of the particular circuit to enable some improvement to be

effected. It cannot be expected that the unusable time will be reduced significantly, since even in the case of well established ionospheric research stations such as Slough, the standard deviation is still of the order of 12%.

Other ionospheric factors

In addition to the problems caused by exceeding the frequency limits determined by the MUF and LUF, there are other factors that prevent successful communication, such as sudden ionospheric disturbances (SID), fading, and unpredictable gaps in the frequency spectrum.

Complete statistical information on (SID) is not available, but an idea of their nuisance value can be obtained from published data on observations made at Washington, D.C.⁴ During the sunspot maximum year 1937, SID were observed on 84 days. On 66 of these the SID were classified as intense, on 39 days there were more than one SID, and on 33 days the SID lasted more than an hour. In the sunspot minimum year 1944 the corresponding numbers were only 5, 3, 0 and 2. In the sunspot maximum year 1947 they were again high at 121, 104, 54 and 33.

Five principal types of fading have been observed. Interference fading occurs when two or more waves arrive at the receiver over different paths and the phase varies in one or more of the paths due to motion of the reflecting layer, body or particles. When waves from a number of air paths combine, the random variations of phase tend to smooth out and the effect is a flutter of the received signal. However, if waves from a single air path in which the phase is fluctuating is received at a strength comparable to that of the group-propagated wave, the fading is very severe. This occurs particularly at frequencies between 1 and 2 Mc at distances from 50 to 200 miles.

Polarization fading is the result of fluctuation of the direction of polarization in one or more of the paths. Its effects are most severe in ionospheric propagation.

Absorption fading is a slower type and may occur along a single transmission path, due to variations in absorption somewhere in the path. The severe fade-outs associated with an SID are an extreme case of absorption fading.

Skip fading is due to fluctuation of ionization density at the place in the ionosphere where the wave is reflected, which cause the skip distance to increase and decrease. The resultant changes in received field strength may be more than 100 to 1. This type of fading is most prevalent around sunrise and sunset.

Selective fading is the result of quantitative variation with frequency of any of the other types of fading. The various frequencies in the sidebands are received with varying amplitudes or phases, resulting in distortion of the signal. This effect is most important in broadband communication such as telephony, where the deletion of some frequency components distorts the speech signal.

In addition, records also show that the frequency spectrum between the MUF and the LUF is not necessarily continuous but that gaps often exist. If the operating frequency falls in one of these gaps, communication is not possible. The typical ionogram in Fig. 3 shows these gaps, particularly between 14 and 23 Mc.

Oblique sounding provides solution

Considerable research has been carried out since 1954 by Canada's Defence Research Telecommunications Establishments into the use of oblique rather than vertical sounding techniques.^{5,6} The program had two main objectives: to check the theory of ionospheric propagation at oblique incidence; and to improve systems of predicting optimum

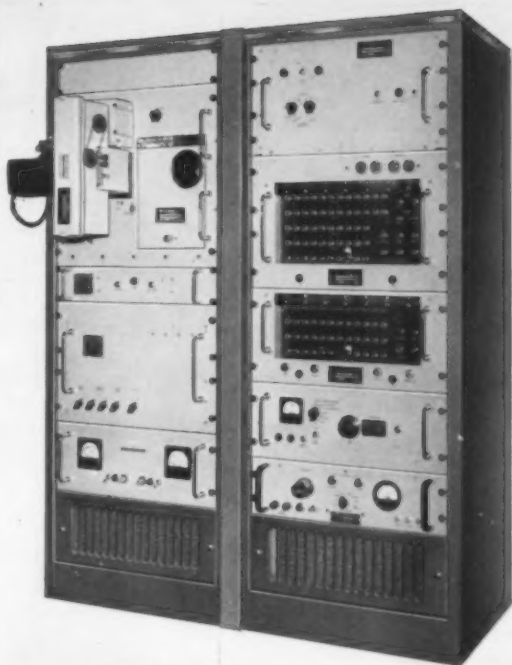


Fig. 2. Receiving terminal of Philips oblique sounder.

working frequencies. Much of the equipment for use in this program was designed and built by Philips Electronics Industries Ltd. Toronto.⁷ Some units were also supplied to the Massachusetts Institute of Technology for use in their investigations in the U. S. A.

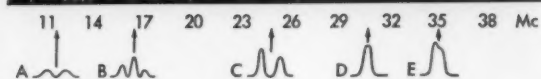
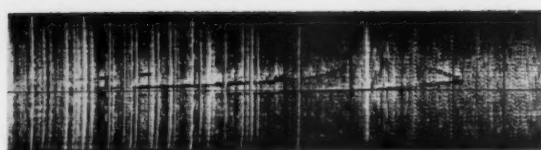
The DRTE program has revealed minor discrepancies in the theory of propagation at oblique incidence, and major inadequacies in the assumptions implicit in prediction systems. Plans are under way at DRTE to produce an improved prediction system, but this will only provide better estimates of median MUF values. It cannot answer the question as to what is the optimum frequency to operate on at a particular time for a particular route.

Philips have subsequently developed more advanced oblique sounding equipment for use in ionospheric research programs or as a direct aid in improving the performance of HF communication networks. By measuring the actual propagation conditions in parallel with the communication circuit, the sounder can provide an indication of conditions in the immediate future and make more reliable communication possible.

Sounders have been supplied to various U. S. government agencies and have been mounted in both trucks and aircraft for use in extended ionospheric communications research programs.

The wide frequency range of the Philips sounder is achieved by using an HF transmitter and receiver (1.05 to 24.95 Mc) and a VHF transmitter and receiver (25.05 to 48.95 Mc). A typical VHF receiving terminal is shown in Fig. 2; the corresponding transmitting terminal is housed in a similar cabinet. If both functions are required at one location and/or the full frequency range is specified, the equipment is repackaged and duplicated units are eliminated.

A flexible time programmer, capable of initiating a program at any minute of the 24-hour day, ensures that



Received signals

- A Lowest usable frequency (LUF), low signal strength, multipath propagation.
- B Multipath signal, lower amplitude than C.
- C Multipath signal, subject to interference fading if signal amplitudes are within about 6 db.
- D Single signal of good amplitude, subject to polarization fading only.
- E Maximum usable frequency (MUF), multiple signals, maximum amplitude.

Fig. 3. Typical ionogram. Sweep is synchronized with frequency scanning, relative delay is displayed vertically, signal strength modulates brightness trace.

frequency scanning starts simultaneously at each terminal. The sounder then scans over the frequency range in constant increments of 100 kc.

A frequency scanning program may easily be set up to allow rapid scanning (1-Mc steps) over parts of the spectrum of no current interest, and slow scanning (100-kc steps) over selected parts of the spectrum. The scanning rate in presently available equipment is two steps per second. Thus, if the bands from 10 to 11 Mc and from 16 to 20 Mc only were of interest, the total scan would take less than 34 seconds, as compared with two minutes if the entire band from 1 to 25 Mc were scanned in 100-kc steps.

The transmitted pulses are gaussian in shape to reduce interference with adjacent communication systems. After detection and amplification by the appropriate receiver at the opposite terminal they are passed on to the display unit. This includes two oscilloscopes: an A-scan unit that provides a visual presentation of video information; and a B-scan unit to which a camera is attached for permanent recording of propagation conditions. These photographic records (ionograms) show received pulse delay plotted vertically against pulse frequency, with Z-axis modulation by the signal amplitude.

Accurate timing essential

A highly accurate timing system is obviously essential to measure the relative delay of the pulse received from the other terminal. When no ionospheric blackout is experienced the system timing may be adjusted so that the received pulse will appear during the 8-millisecond (minimum) display time. However, adjustment is not possible during a blackout, and the transmitter gating pulse at one terminal and the gating pulse for the display unit at the other must remain stable within a few microseconds of each other, and must not drift more than a millisecond a day. Accuracy of the order of 5 parts in 10^6 per day is therefore required. Provision is also made for synchronizing the timing of the two terminals with world standard time signals such as those transmitted by CHU and WWV.

Improved communication operations

The communication capacity of the high frequency spectrum may be increased in several ways by the use of oblique ionospheric sounding techniques:

Determination of the true maximum and minimum

usable frequencies permits the widest possible use of the spectrum. For example, MUF's as high as 47 Mc have been recorded on the North Atlantic route.

Knowledge of path attenuation characteristics may permit a reduction in transmitter power output, with an attendant reduction in interference with other services and an economy in equipment operation.

With knowledge of the possibility of multipath propagation it becomes possible to restrict low-grade information to multipath frequencies and put strategic voice or high-speed, high-accuracy digital information on preferred frequencies, usually near the MUF.

Redundant transmissions can be reduced by using a knowledge of the rate of change of the propagation conditions to predict the optimum time to change the operating frequency of the communication network.

Although some interference is generated simply by the act of sweeping over the frequency spectrum, this is minimized by the use of a narrow gaussian shaped pulse; a frequency synthesizer with a total harmonic and spurious output of better than -63 db; and stepped tuning in the transmitter power amplifier stages that further reduces harmonic and spurious radiation.

The cost of installation and maintenance of sounding equipment, when weighed against increased message carrying capacity and reliability, appears small compared to the cost of installing and operating a more sophisticated communication system.

Development work continuing

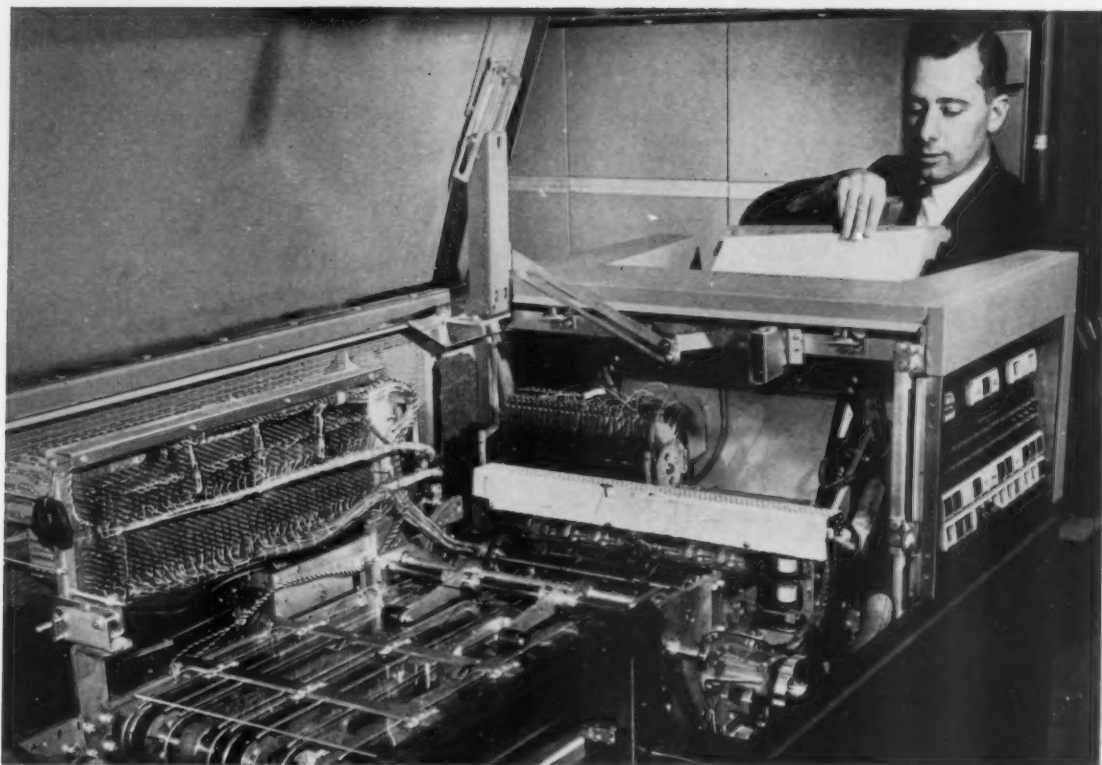
Second-generation systems now being developed in Toronto will incorporate the results of extensive miniaturization of the individual units. Other development programs are under way in the areas of simplifying the equipment or increasing its over-all flexibility for special applications; signal extraction; and digital processing. The latter should lead to display systems that will indicate numerically the best frequency to use at any time. A system is also under consideration that would automatically change the operating frequency in accordance with priorities, the direction of movement of preferred frequencies, the type of information being transmitted, and the allocated channels.

Based on the experience already gained in this development work, Philips can also provide vertical sounders with superior characteristics to the C4 used in the IGY program, and panoramic radars for missile trail detection and other applications.

END

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Processing information from Canada's 1961 census is being speeded by this document reader developed by International Business Machines at Endicott, N.Y. In this National Film Board photo, an operator is shown loading census forms into the reader. The reading head is under the lamp housing across the middle of the machine.

Business machine reads census forms

RICHARD GWYN, OTTAWA EDITOR

In 1666 the first Canadian census was taken. It revealed a population of 3,315 and special attention was paid to the number of firearms and swords in general use. This summer, the decennial census has grown to a mammoth operation requiring nearly 30,000 enumerators in the field and a staff of some 2,000 to process the information at the Dominion Bureau of Statistics (DBS) in Ottawa.

Equipment for tabulating information has changed — from the quill pens of 300 years ago, to a modern computing system today.

In the early planning at DBS for a tabulating system for the 1961 Canadian census, a team headed by Rudy Ziola of the Bureau's Electronic Computer Processing Unit made a survey of computing systems. Mr. Ziola was assisted by E. L. R. Webb of the Radio and Electrical Engineering Division of National Research Council.

The basic systems chosen were an IBM 705 III, and IBM 1401C. The 705 III is a large capacity system capable of card or magnetic tape input. The 1401C is a lower capacity data processing system with features which make it a convenient system for preparing and editing data prior to processing it in the 705 III.

To achieve the maximum potential of the 705 III, the Bureau decided to avoid the use of punched card input which would impose an operating limitation of 333 characters per second. That was judged to be too slow for tabulating the information to be collected from over 18 million people in answer to 26 separate questions, plus the lengthy housing questionnaire to be completed by some 900,000 householders and an agricultural census comprising 187 questions to be asked of about 600,000 farmers.

Hence the decision was taken to use the, at the time, untried IBM 797 Document Reader System. It can take information directly from documents and store it on magnetic tape for processing.

The document reader can process 150 census documents a minute, each comprising the answers of four persons to 26 separate questions. The information is first put onto tape at a density of 200 bits per inch. The tape is then edited in the 1401C to reach a density of 556 bits per inch before being processed in the 705 III. At this density the 705 III can operate at 62,500 characters per second.

(Continued on page 40)

Contracts and expenditures for defense electronics and communications equipment in thousands of dollars

Canadian Government Defence Contracts and Expenditures in:	1958		1959		1960	
	Contract	Expend.	Contract	Expend.	Contract	Expend.
Canada	58,296	73,749	80,373	83,264	99,301	73,307
U. S. A.	12,864	24,830	294	14,734	34,023	13,472
U. K.	2,143	784	1,514	1,870	156	982
Other	106	106	119	118	137	133
Total	73,409	99,469	82,300	99,986	133,617	87,894
United States Defence Contracts and Expenditures in Canada	12,756	13,025	35,804	19,491	14,752	38,238

Defence electronics procurement topped \$133 million in 1960

This is a summary of news pertaining to electronics and contained in the Tenth Report of the Department of Defence Production for the year 1960. Copies of the full report may be obtained by ordering Catalogue No. P1-4/1960 from the Queen's Printer, Ottawa. Price is 35 cents.

Under the provisions of the Defence Production Act, the Department of Defence Production (DDP) has exclusive authority to procure the goods and services required by the Department of National Defence and the responsibility to ensure that the necessary production capacity and materials are available to support the defence production program.

The Department also serves as procurement agent for the Canadian Commercial Corp., a Crown company primarily responsible for the purchase in Canada of defence goods required by other governments and of supplies needed to meet Canadian commitments under the Colombo Plan and other international agreements.

In 1960, the Emergency Supply Planning Branch was established within the Department to carry out the task of planning and making other necessary arrangements to provide for the immediate establishment of a War Supplies Agency should there be a nuclear attack.

Procurement and construction activity for the Canadian defence program, as measured in terms of payments to contractors, declined in 1960 for the seventh consecutive year. At \$620.6 million, expenditures were 7.8 percent lower than in 1959. On the other hand, commitments to business and industry, as reflected by the net value of contracts issued, were much greater in 1960. The value of new contracts and increasing amendments to existing contracts, less decreases and cancellations, amounted to \$805.9 million, 36 percent more than in the preceding year. For the first year since 1954 the volume of new commitments exceeded the value of expenditures, thus increasing the amount of outstanding defence business during the year by \$185 million.

Canadian defence expenditures made to prime contractors located outside the country represented 9.5 percent of total cash payments during the year. This was an increase over the 6.7 percent paid abroad in 1959. As usual, the greatest value of payments abroad, \$58.7 million, went to the United States. However, United States Government spending on prime contracts placed in Canada, which totaled \$85.5 million in 1960, was much higher than Canadian prime defence spending in the United States. As in past Reports of the Department, these figures reflect only expenditures to prime contractors of this Department and Defence Construction (1951) Limited, and do not represent the total flow of Canadian defence expenditures into the United States nor of United States defence expenditures into Canada.

Electronics

Canadian defence requirements for electronics and communication equipment involved the expenditure of \$88 million in 1960, down from \$100 million in the preceding year. New commitments, however, increased significantly to \$133.6 million from \$82.3 million in 1959. In addition to expenditures on Canadian defence electronics requirements, about \$38 million was spent in Canada by the United States for electronics supplies during the year, and a beginning was made on production for the United Kingdom and the Federal Republic of Germany.

In the field of radar, the production of search and height finding radars and of fibre glass radomes neared completion. These items were being produced to meet the requirements of both the Royal Canadian Air Force (RCAF) and the United States Air Force (USAF). Production continued on counter countermeasure equipment for both these Services, and on selective identification equipment. The development and production of data processing equipment was a significant contribution to the air defence radar program. Production commenced on battlefield surveillance radars for the Armies of both Canada and the United States.

Production on two major search and attack sonar programs continued during the year, as well as on the Cana-

dian designed variable depth sonar. Additional production on the variable depth sonar was initiated to meet requirements of the Royal Navy. A miscellany of naval navigation equipment, such as gyro compasses, logging equipment and plotting tables, was produced. Sonobuoy development and production was continued for the RCAF and the USN.

Production and installation continued on air defence communication (ADCOM) for the RCAF. Planning for semi-automatic ground environment (SAGE) communications in Canada continued, and initial contracts were placed for the lease of long line and on-base systems. Rearward communications for the Ballistic Missile Early Warning System (BMEWS) were completed during the year. Production in the United Kingdom for Canadian Army vehicle communications continued, and contracting for three major Army communication projects was begun. Production also continued on the communication requirements in Canada of the United States Army. Procurement was initiated for the radio transmitting and receiving equipment for new naval ships.

A major program in the area of aircraft electronics was the production of the NASARR system of fire control and terrain avoidance for the CF-104 aircraft. Communication, navigation and identification equipment for several major new programs and retrofit programs continued in production. Considerable development work took place on airborne anti-submarine electronics, including a sonobuoy receiver retrofit program.

Activity in the training aids (simulator) field continued at a high level. Development on an Argus tactical crew procedure trainer neared completion, and programs were completed in connection with the Argus operational flight trainer and general purpose flight and instrument trainers. A major program was undertaken for the supply of CF-104 operational flight and tactics trainers, including requirements for the Federal Republic of Germany, the Netherlands and Belgium. A requirement for a tactical trainer for the Royal Canadian Navy was met, and work began on a models control trainer for that Service. The Department continued its administration of an automatic letter sorter program for the Post Office Department.

Considerable activity was devoted to the operation and maintenance of the mid-Canada early warning line.

Installation of new radar, data processing, communication, navigation and identification equipment, largely for the U.S. military services, required substantial effort during the year.

The procurement of component spares for both the Canadian and U.S. Services continued at a significant level. The Department's program to establish qualified sources of supply for component parts and materials progressed satisfactorily, with 20 contracts having been placed with Canadian firms. Seven additional projects were under negotiation at the end of the year.

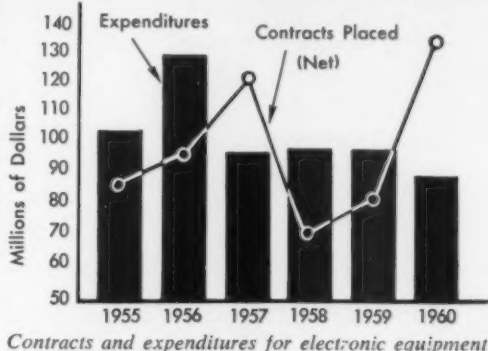
Defence production and development sharing

During 1960, the Department's activities in connection with the Canada-United States defence production and development-sharing program were increased. The value of United States prime contracts and sub-contracts received by Canadian industry that were related to the production-sharing program amounted to \$112.7 million in 1960 as compared with \$96.3 million in 1959.

For the electronics industry alone, totals from the start of the program in January, 1959, until the end of March, 1961, are:

Prime contracts	\$45.3 million
Sub-contracts	\$55 million
Total	\$100.3 million

(Figures supplied by DDP at Canadian Military Electronic Components Symposium, Ottawa, April 1961.)



Contracts and expenditures for electronic equipment

The encouraging increase in electronics procurement in Canada by the United States and other countries of the North Atlantic Treaty Organization was assisted by the maintenance of a small group in the Electronics Branch directed toward identifying and following up defence requirements in certain areas where this country has a production capability.

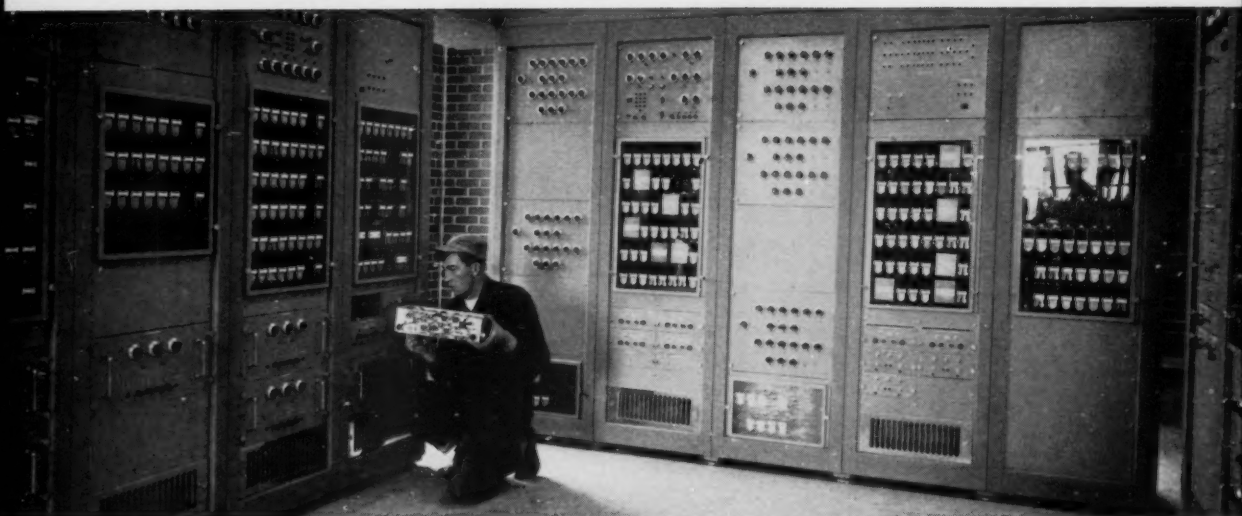
DDP continued its campaign to complete the listing of Canadian companies as sources for United States Government requirements. Departmental officers, through visits to U.S. procurement centres, and through U.S. and Canadian industry, trade associations, trade fairs and symposia, were able to obtain information and provide useful guidance to participants in the program.

The success of these efforts is shown by the significant increase in bid solicitations and submissions in both the prime and sub-contract areas during 1960. In the sub-contracting area, which was virtually nonexistent prior to the establishment of the production-sharing program in the fall of 1958, invitations to bid rose from some 1,900 in 1959 to more than 2,700 in 1960. Replies to these bids rose from approximately 1,400 to more than 2,100. U.S. sub-contracts received by Canadian firms numbered 882 with a value of \$51.7 million, as compared with 365 valued at \$45.3 million in 1959.

The Department provided further financial assistance to Canadian firms, primarily in the electronics and aircraft fields, by absorbing part of the Canadian contractors' preproduction and tooling costs, thus putting them in a more equitable competitive position with U.S. contractors. Normally, American contractors have an advantage because most of their preproduction and tooling costs have been written off under previous contracts. Payments amounting to \$630,000 were made to Canadian firms in 1960 for this type of assistance, and new commitments made totaled \$307,000.

Increased emphasis was placed on the research and development aspects of production sharing in 1960. This involved the continuation of financial support for a long-term defence development program aimed at maintaining and improving Canadian industry's scientific and technical competence so that it will be able to participate fully in future United States defence production programs. This support took several complementary approaches to defence development in the United States. The Department ratified procedural arrangements with the U.S. Army and continued negotiations with the USAF with the result that certain United States development requirements will be undertaken and financed in Canada. In support of un-

(Continued on page 37)



General Railway Signal Co. analog computer provides automatic control of the retarders which govern the speed of freight cars as they roll into classification tracks. Computer is housed in temperature-controlled, dust-proof room.

Electronics speeds freight car sorting

A special analog computer, data processing equipment, closed-circuit television, two-way radio, teletype, and tape recorders all play a part in speeding the sorting of freight trains in Canadian National Railways' new classification yard at Moncton, N.B. This is the forerunner of three more such yards to be built over the next few years.

Good communications and mechanical efficiency in the giant freight classification yards of today's railways are of prime importance if the railway companies are to receive the greatest return on their investments. Canadian National Railways' new \$15 million Moncton yard illustrates how electronics, in a marriage with railway physical plant, can achieve this.

On an 830-acre site that three years ago was burnt-out woodland, the new yard has such modern aids as analog computers, integrated data processing equipment, closed-circuit television, radar, two-way radio, teletype and tape recorders to speed the sorting of freight trains. At Moncton, electronics and gravity have teamed up to make the yard work at its optimum.

Analog computer controls cars

Nerve centre of the yard is an analog computer. With the aid of allied equipment throughout the yard and surrounding region, the computer takes into account every factor governing a freight car's movement and controls it during its journey in the classification yard.

However, the sorting of more than 2,000 cars a day cannot be divorced from the area's other railway operations. The yard is a focal point for freight cars in its region. If cars are to be designated to specific tracks, advance information must be received by the yard office

to expedite switching arrangements and car servicing and repairs.

To keep track of the thousands of freight cars moving daily through Moncton yard, as well as other centres in the Maritimes and the rest of Canada, CN uses a mechanized bookkeeping system with IBM equipment. This integrated data processing (IDP) system provides a new method of car accounting in which information is automatically correlated and relayed far and wide electronically.

At the yard IDP is used in compiling the switch list guide needed by the yard foreman. Such information as the car's identification number, destination, contents and service requirements is received at the IDP centre in the form of punched cards and is called the "advance consist."

Before a freight train arrives at Moncton, each car is assigned a classification track marked on the card. In most instances however, the train has picked up cars since the advance consist was transmitted.

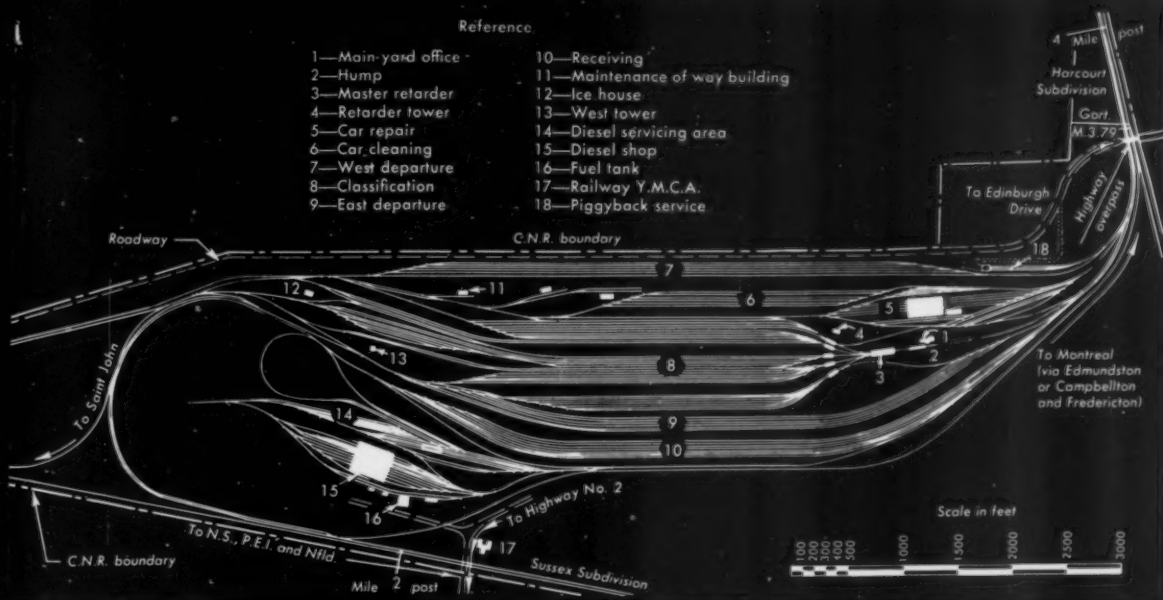
Closed circuit television

In such cases, television cameras scan the sides of the cars as they enter the yard. A car checker watching the TV monitor in the main yard office dictates the numbers into a tape recorder. The record can be used for checking purposes later.

Car inspectors with walkie-talkies check the length of the train for defects. If they find a car in need of repair, they report the car's number to the main yard office and when that car's turn comes to be humped, it is directed to the repair tracks.

All the information gathered by the car checkers and inspectors is given immediately to the IDP centre which prepares punched cards for the extra cars.

Cards for the entire train are then fed back through the IDP equipment. Three teletypes, working in unison with IDP, produce a written form of the switch list



CNR's Moncton classification yard covers 830 acres, is 2.2 miles long and 2,700 feet wide at its broadest. The 79 miles of track provide a standing capacity of 5,062 cars. Complete facilities for repair and cleaning are included.

simultaneously in the offices of the hump conductor, the yardmaster and the retarder controller. The humping operation then begins.

Four cars a minute

The cars are pushed up a man-made hill, or "hump" in railway parlance, uncoupled at the crest and allowed to coast down the other side, one every 15 seconds. At this rate (100 cars in 25 minutes) speed and accuracy in sorting are essential.

The hump foreman, located in the control tower at the crest, and working from the switch list prepared by the IDP centre, directs the cars into their designated tracks by pressing switch-regulating buttons on the control panel.

Once the car is on its way down the hump, it is controlled almost entirely by electronic equipment. The yard electronic control system guides cars whose characteristics are within normal limits so that each car arrives at its destination on the classification track at a safe speed.

During the descent, the computer is fed such information as the car's speed, determined as it trips treadles at each end of an exactly graded piece of track; its weight, measured on a weigh rail; wind resistance on the hump; and the count of cars already on the classification track to which it is destined, which gives the distance the car has to travel. Additional speed measurements are made by radar speed-traps in the master retarder and at the foot of the hill where the tracks branch out.

The computer calculates the proper braking effect required to ensure the car will arrive at a safe coupling speed. On its way down the hump, the car also breaks a light beam focused on a photoelectric detector. The retarders are then applied to slow the car.

Computer checks own operation

The computer equipment used at Moncton is of the latest design; it continually checks its own operation by solving a sample problem, so that any failure in the system is instantly detected. The associated electronic and relay equipment is plug-connected on racks in the retarder tower, and check points are available to verify the output signals. At any time, the computer's automatic operations

(Continued on page 36)



Yardmaster supervises all phases of the operation from this console, heart of the yard communications network.



Operator in retarder tower checks that cars roll into assigned tracks; levers permit manual control of system.



Switches and signals directing trains entering the yard are controlled from this board in the main yard office.



Computer takes control after cars are uncoupled at the crest of the hump separately or in units of up to five.



Wheels actuate treadles at each end of exactly graded length of track to provide measurement of car's speed.

can be superseded by manual control. The Moncton installation was made by the CN signals department under the direction of R. T. Sansom, signal engineer.

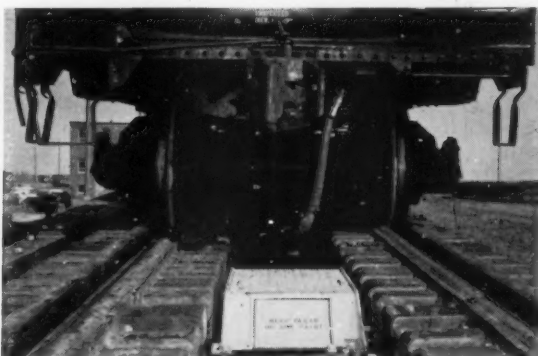
Radio and intercom widely used

From the classification tracks the cars are taken by one of the nine radio-equipped yard switch engines from the lower end of the yard and placed in set-off order in the departure tracks. Switching is done entirely without hand signals, directions being given by radio.

For maximum efficiency and safety, the movement of the diesel engines that push the cars over the hump is governed by signal indicators on two signal standards on the way to the hump, and repeated on a panel in the cab of the locomotive. A green signal means approach the hump; yellow, proceed at two miles per hour unless otherwise directed; red, stop; and flashing red, back up.

Canadian National Telegraphs has installed three independent telephone exchanges at Moncton yard totaling 150 lines, to provide direct communication between the numerous buildings and outside points; five separate radio systems for use by the yard engines, car inspectors and radio-equipped motor vehicles; ten teleprinters capable of operating at 100 words per minute to transmit train consists; and nine talk-back paging systems providing links between various sections of the buildings and between the hump operation buildings and field employees.

To serve these facilities, CNT installed more than 15 miles of underground cable, 12 miles of paired wire,



Radar speed traps between rails in master retarder and at foot of hill provide further information to computer.



Retarders are activated when rolling cars break light beams focused on photoelectric devices beside tracks.

one mile of conduit and 6,000 feet of coaxial cable for the television system. In addition, a cable five miles long and containing 152 pairs of wires, links the yard with other CN offices in the city.

Car routing labels

Besides holding the distinction of being Canada's first automatic hump yard, Moncton yard also features Canada's first application of mechanically-prepared car routing labels.

Previously, labels listing the car's number, contents, destination and servicing requirements were attached at points along the route. Under this system a car might require as many as 25 different labels to take it across the country. Now one is sufficient to direct its movement from loading station to destination.

The idea of mechanically writing the labels is the result of some observations by CN's system supervisor of terminal operation, E. B. Ryerson. He saw that all the information required on the labels was already being transmitted from punched cards to teletypes in various sections of the yard.

Mr. Ryerson decided that since one of the points receiving this information happened to be the hump conductor's office where the classifying took place, that would be the ideal location to label each car. He also reasoned that time would be saved if the labels could be produced at the same time information for classifying was being transmitted.

Canadian National Telegraphs engineers then came up with their "inter-coupler" which transmits the information to teletypes that can write 100 words a minute. New York Central Railway executives have shown interest in CNT's solution.

Equipment and suppliers

Moncton yard's vital communications and signaling statistics line up like this:

—GRS Class-Matic automatic retarder control (analog computer) supplied by General Railway Signal Co., Rochester, N.Y.

—Ninety-Six paging and talk-back speakers by R. W. Neill Co., Chicago, Ill.

—Five radio communications systems and nine two-way radio-equipped locomotives using Bendix 2-R series equipment.

—Four television cameras and 3 monitors by Tel-Autograph Corp., Los Angeles.

—Ten teleprinters, model 28, by Teletype Corp., Chicago.

—Twenty-four RCA Victor "Personafone" pocket transmitters, coupled with 24 Motorola "Handie-Talkie" receivers. This system is linked with nine radio base stations employing Bendix 2-R series equipment.

—Three independent type 5-5100 telephone exchanges by Amalgamated Electric (GEC).

—Six Telefunken tape recorders.

—Thirty miles of cable, of which almost half is underground.

More yards coming

Moncton yard is the first of four giant freight classification yards being built by Canadian National. This summer, CN plans to open its new Montreal yard, largest in North America. Early next year the Symington yard will open at Winnipeg, and in 1965 the largest of the four will be in operation at Toronto.

The impact electronics will have on railway operations can be judged by the benefits CN is receiving from Moncton yard. The company is able to reduce the average yard time of freight cars from 24 hours to approximately four — a reduction of 80%. When the Montreal yard is operating in co-ordination with the Moncton project later this year, the railway foresees trains running between the Atlantic seaboard and Central Canada in about half the time it takes today.

END

Defence Electronics — continued

iquely Canadian projects whose successful development is expected to be of interest to the U.S. Services, the Department provided assistance to competent Canadian companies. Further, to improve Canadian industry's position to compete for U.S. financed development requirements, the Department shared the cost of selected projects with the U.S. Government and the Canadian companies concerned.

Contracts valued at \$2,425,000 were issued in 1960 for this research and development assistance, with payments amounting to \$2,033,000. In addition to these contracts, there were a number of projects under active consideration, including several unique Canadian concepts and formal U.S. requirements approved in principle for support, totaling \$12 million. Canadian companies received almost \$3 million in U.S. defence research and development business during the year. The development projects were in such areas as navigational aids, communication equipment, anti-submarine warfare equipment, gas turbine engines, and vertical and short take off and landing (VTOL and STOL) aircraft.

Industry and defence

The Department continued its program to establish sources in Canada for electronic component parts and materials essential to the production of modern military electronics. The object of this is to establish qualified

sources of supply sufficiently in advance of requests from the Department of National Defence in order to ensure the maximum participation of Canadian firms in defence procurement, particularly in the electronics field. Because of the urgent nature of many military requirements, this advance qualification will make Canadian producers less dependent on United States and other sources of supply. A further aim is to prove the capability of producing a requirement at a highly competitive price as well as to require performance standards, thus enabling Canadian sources to meet both United States and Canadian demand. Contracts valued at \$512,000 were issued in 1960 to provide for the establishment or extension of qualified sources for the production of certain types of capacitors, resistors, potentiometers, tachogenerators and miniature blowers, for the development and evaluation of high performance electronic components, and for the establishment of a ceramic manufacturing facility.

The Department continued to encourage private industry to make its own investment in the capital equipment required for defence production. In this way, defence production capacity would be more directly tied in with the general structure of Canadian industry. In some cases, however, direct Government investment and financial incentives were necessary to ensure the capacity essential to defence requirements. Such Government assistance to private industry was small in 1960.

END



Central control room of the Lenin hydro-electric station at the town of Volzhsky makes extensive use of electronics.

Soviet industries make increasing use of electronic control techniques

VLADIMIR E. NIZE*

Initial attempts to use electronics in industry date back to the late 19th century soon after Hertz had discovered the photoelectric effect and Stoletov had devised the first photoemissive circuit to measure radiant flux. However, practical electronic circuits became possible only after Lee de Forest invented the triode early in the 20th century. Thus, ground was broken for the application of electronics to industrial needs.

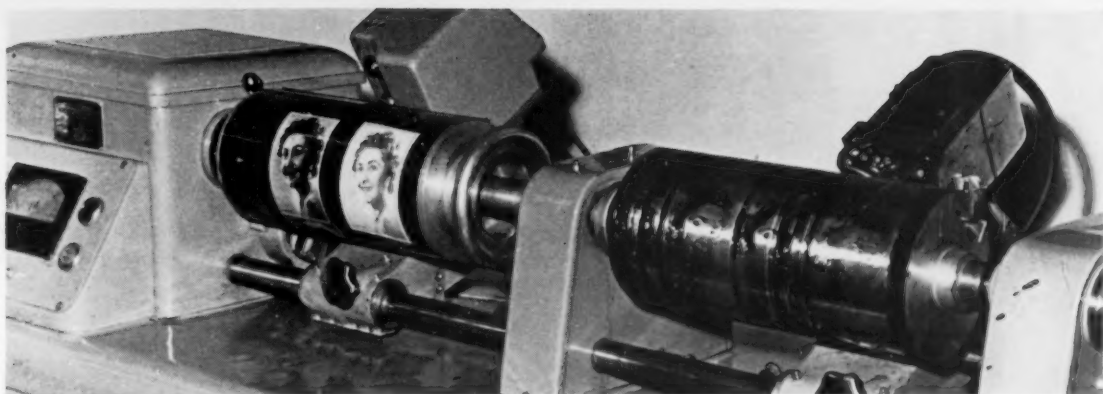
In the Soviet Union, industrial electronics has been receiving a good deal of attention. Among other things, a special committee has been set up at the U.S.S.R. Council of Ministers, responsible for the application of electronics to automatic control.

To date, automatic control has made much headway in many industries. In metal making, photocells have greatly simplified automatic control of temperature and

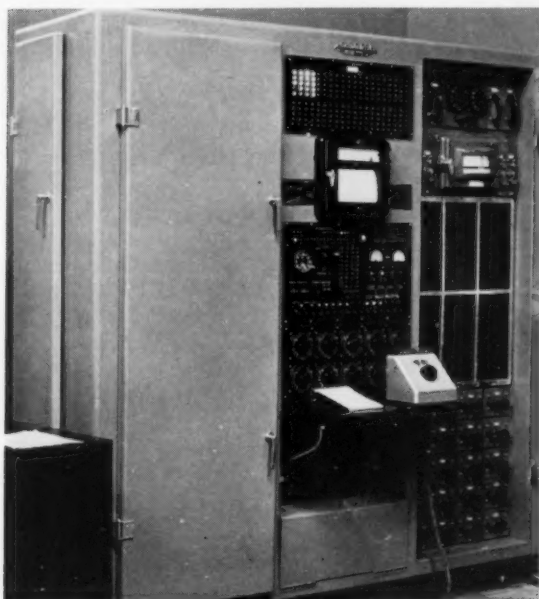
gas analysis in blast furnaces. Electronic computers employed for automatic control of Bessemer converters have appreciably reduced the number of failures and doubled the proportion of melts with the optimum carbon content. Electronic "brains" operating soaking pits have improved the heating of ingots, cut down fuel consumption and reduced the number of passes an ingot has to make through a rolling mill. This has in turn raised the throughput of rolling mills. The automatic shape-calibrating control system installed at the Magnitogorsk iron and steel mill has been saving both time and labor.

In the chemical industry, adaptive control systems take care of the most involved processes. Keeping a constant watch on the stock, control agent and environment, they maintain the process variables within the optimum limits and turn out finished products of high quality. One such system installed at the Stalinogorsk Chemical Factory paid off the money invested within six months of operation. Similar results have been obtained by Soviet refineries.

*Engineer, Moscow. This article has been prepared for CEE through the co-operation of the Press Office, U.S.S.R. Embassy in Canada, Ottawa.



The EGA-1 automatic electronic engraving machine has supplanted photochemical method of making printing plates.



This picture shows the MARS-200 electronic computer on display at the USSR Economic Exhibition held in Moscow.



The AS-28 is an electronically controlled drilling and milling machine designed on a building-block principle.

In the machine-tool industry, electronics has led to the development of many reliable gauges and automatic metal-working machines and transfer lines. Photocells sort out steels by grade, inspect parts for size and defects in workmanship, trace out the desired pattern direct from a blueprint on sheet metal cut by gas cutters or on parts worked by metal-cutting machines. Electronic computer elements have become an integral part of program-controlled machine tools. Powerful ultrasonic generators are coming into ever-wider use in mechanical engineering. High-frequency induction heating units built into production lines quickly heat-treat the parts right in the flow.

Electronic and radioactive gauges provide a continuous check on the size, surface finish, and shape of parts immediately on machine tools or in transfer lines, thus radically reducing the rejection rate.

The printing industry has been among the first in the Soviet Union to employ photocells for automatic control. Such devices are advantageously used in platen presses, rotary presses, stitching and other machines in the industry.

Good results have been obtained in reproduction processes. Electronic engraving machines produce high-quality plates quicker than by the photomechanical method.

In the food industry, electronic instruments and automatic devices keep watch on the quality of foodstuffs, count semi-finished and finished products, control process variables, pack bulk products and bottle liquids. Electronic components perform a variety of duties at mechanical bakeries.

Electronic components go into automatic systems employed in research and design work and in management.

The use of cold-cathode electron tubes and transistors instead of electromagnetic relays in automatic machines and transfer lines substantially improves their reliability.

The current seven-year plan provides for an increase of 80% in gross industrial output in the Soviet Union compared with 1958. This will be mainly done through increased labor productivity. The main lever to achieve this goal will be industrial mechanization and automation on the basis of electronics.

END

Census reader — continued

Bulk of the tabulation work involved in the census amounts to straight addition, though a complex system of checking completed documents for consistency in answers was developed by a Bureau team headed by Rudy Ziola. It involves the placing of some 20,000 instructions in the memory of the 705 III computer.

The document reading system consists of four main units: control unit, document reader, storage unit, and tape unit.

Control unit

The control unit is essentially a timing mechanism to ensure that all phases of the operation are synchronized for each census document. Interlocks are provided to prevent operation of a unit until it is ready to accept or transfer information, or to carry out its normal function.

Document reader

Its essential components are a feed hopper, feed mechanism, reading mechanism and a stacker. To load the hopper a plate, which engages one of two lift systems, is inserted into the bottom of the hopper and loaded with documents, placed face up with the leading edge toward the throat. Once started, the documents automatically move to the feed position and come under control of a deck level indicator to keep the top document sheet at proper feeding level. Air pressure is used to single out a document and pull it toward the feed mechanism. Cotton conveyor belts and special guides move the documents past the reading head and into the stacker at a rate of 150 per minute.

In the reading head, light from a tubular lamp is focused onto an aperture plate directly above the moving document. Baffle plates divide the aperture into 32 sections, each of which is aligned with a column of information on the document. Black pencil marks made by enumerators on the census documents produce a change in the amount of light reflected from the paper. This is detected by solar cells located near the apertures. There is one cell for each opening or "column".

A duplicate set of lamp, aperture, baffles and solar cell is located directly beneath the document so that both sides are read at the same time.

Black marks on the census document produce a change of voltage of about half a millivolt in the solar cells. These impulses are amplified through four stages to produce signals of about 50 volts which can be recorded in the temporary thyatron storage unit.

The census documents are laid out in a grid system of lines and columns. Four complete forms are printed on each document — two each side. Marking positions for answers to questions are staggered on the opposite sides so the document reader can scan both sides at the same time without interference from "read through."

Down the left side of each document are 74 checking marks. Each one represents a "line", and signals from them must coincide with the appropriate signals from the "columns" before information can be registered in the temporary store.

A second check is provided by 32 skew marks placed at the bottom of the document. If any of the marks are not read it indicates the document is skewed with the probability that answers to questions have been missed by the reader. A light on the operator's console indicates this condition and feeding can be stopped if skewing is persistent. The skew marks, if not all read, also indicate a solar cell is not operating.

One of the most interesting features of the document reader is its method of aligning documents so that proper reading can be carried out. Rather than using a side guide to align the paper under the reading head, the light aperture plate is moved by three magnets to align properly with the document. This is controlled by seven black sensing marks placed at the top of each document.

After the documents have been read they are placed in a stacker. Two stackers are used to permit continuous operation. When one is filled, forms are automatically switched to the other, permitting the first to be emptied.

Storage unit

The temporary storage unit used with the document reader has 2,500 thyatrons. They provide capacity for 500 characters, each represented by a 5-bit binary code.

Each thyatron has two grids which must be energized in coincidence before the tube will fire. One grid receives its signal from a "line" mark, while the other grid receives its signal from a "column" mark. The entire sequence of recording, and establishment of the binary code is programmed by the control unit.

Tape unit

After all the information from a document has been placed in the temporary store a signal is given by the control unit to record it on magnetic tape in the 729 III tape unit. This is done at a density of 200 characters per inch.

Since the 705 III computer is capable of accepting magnetic tape with a density of 556 characters per inch, the 1401C equipment is used to convert the information from 200 to 556 characters per inch to make more efficient use of the 705 III.

Document reader demands close tolerance

As with any new system, the document reader has produced its bugs and kinks. In fact, DBS is acting as a sort of commercial guinea pig for the world in making the first operational use of the reader. Italy is interested in the outcome of the Canadian experiment and may use the equipment for its census next year.

The bulk of DBS's difficulties centred about the exacting tolerances demanded by the reader for the location of marks on the census documents. To cut down cost, the documents had to be produced by commercial printing methods. Also, they had to withstand the rough handling in the field by enumerators going from house to house in all kinds of weather.

The most suitable paper was found to be Howard Smith's Genoa medium bond. This exhibited the quality of flatness to cut down light scattering in the reader, and it had an absence of wax spots to cut down reflections which give false impulses. It was found to have the essential advantage of similar structures on both the 'wire' and 'felt' sides of the paper. Both sides are read simultaneously in the reader.

The pencil finally chosen for use by the enumerators was the round IBM mark sensing pencil. An interesting allied problem was that of erasing marks made in the wrong columns. It was found that erasing along the line would reduce the mark visually, but still produce an impulse of basically the same shape in the reader. However, erasing across the mark creates a smudge and, hence, an impulse of a different shape which can be ignored by the reader.

The actual printing required much closer tolerances than ever met before by commercial printing establishments. It was handled by the Queen's Printer with close supervision by Mr. Webb of NRC. The actual layout of the document, with the need for close, but distinctly

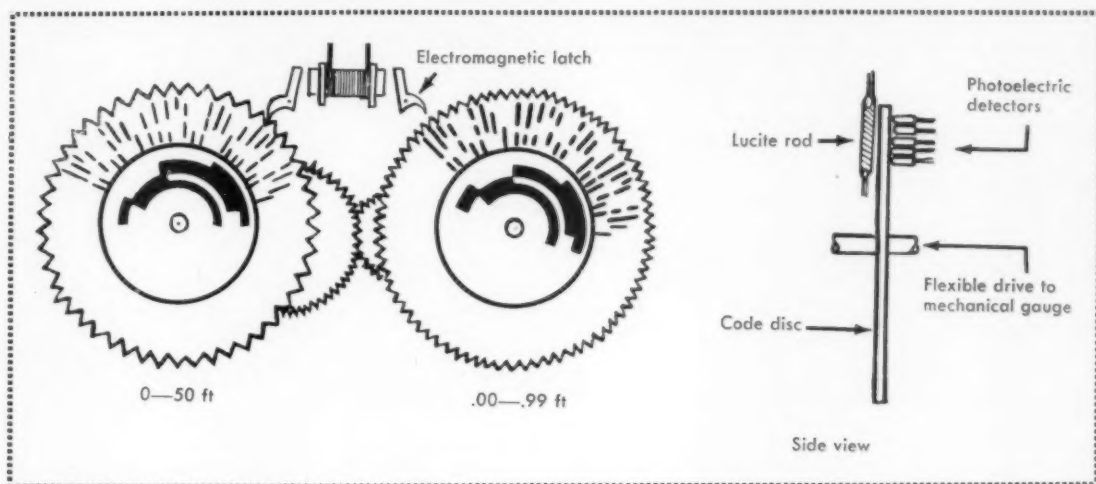
separate spacing of marking points, was performed by the Maps and Charts Section of the Department of Mines and Technical Surveys. Accuracy of printing demanded a tolerance between 0.0002 and 0.0001 inch. Paper used had to be pre-humidified to cut down any tendency to expand or contract between the printing operation and the time it was fed into the document reader after being out in the field.

Another area requiring accuracy far beyond normal standards was that of cutting the paper with one corner precisely square. The shape of the paper was checked on aluminum templates developed at NRC with eight check

crosses etched on the plate by a high precision radial jig borer capable of accuracy to 0.0001 inch. Variations permitted in the shape of the paper were set at one or two thousandths of an inch at a radius of 16 inches. This would compare with a normal shearing of paper where tolerance is kept to only 1/32 or 1/64 of an inch. The first cutting was done in the printing plant and the second at the Bureau after the documents were returned from the field for processing.

Despite these problems, Canada's 1961 census is expected to yield more information than ever before, in less time — due to the help from electronics. **END**

Engineering reports



Telemetering equipment uses photoelectric cells to produce teletype signals **101**

Philco Corporation of Canada Ltd. has developed telemetering equipment which uses photoresistive elements to provide signals for teletype printout of measured data.

By combining variable measured information with pre-arranged signals generated in a programming unit, a complete message can be created and printed out on standard teletype equipment without resorting to special forms or an operator.

In an application recently tested by Philco, the equipment was used to monitor temperatures and liquid levels in tanks at an oil refinery. This is what the information looked like coming out of the teleprinter:

OIL AND GAS REFINERY CO. LTD.
TORONTO ONT.
JULY 31 1961 TIME 1430

TANK	CONTENT	LEVEL	TEMP
01	HY NAPHTHA	16.27 FT.	087 DEG F
02	FUEL OIL #4	27.13 FT.	091 DEG F
03	GASOLINE #2	07.80 FT.	109 DEG F
30	FUEL OIL #5	13.44 FT.	093 DEG F

(Bold face letters denote continuously variable information.)

Each tank at the refinery was equipped with a mechanical float-type level gauge to which Philco was able to attach coded discs for telemetering. The discs are based on the same principle as standard punched cards used in computers. They use perforations to control light from a miniature lamp reaching photoresistive elements. Opaque sections represent "off" positions with the elements presenting maximum resistance in their circuits. Perforated sections represent "on" positions by allowing light to reach the photoresistive elements and reduce their resistance.

Each circular disc is perforated radially to give standard 5-pulse teletype character signals. In the trials at the oil refinery, the coarse discs were perforated to indicate liquid levels in the range of zero to 39 feet. The fine discs were perforated to give .00 to .99 feet.

To avoid ambiguity when the liquid level is halfway between any two increments, the code discs are designed in the form of gears. Immediately prior to readout, an electro-magnet is energized and a lever arm engages the gear teeth to bring the discs into position at the nearest increment. Liquid level is indicated in feet, with two decimal points, such as 35.96 feet. A photoresistive step-

ping switch ensures that the four digits are read in proper sequence.

Other readout figures, such as feet, inches and fractions, can be arranged.

The temperature coding device is of similar construction to the level gauge. One perforated disc is used to provide a 3-digit readout within the range required for any particular installation.

The programming unit controls all telemetering functions from a central office. It contains individual program panels, each consisting of a 20 by 34 contact patch board, a 12-deck, 25-position telephone type stepping switch and an auxiliary 4-deck, 12-position switch. The latter permits the main programming switch to be operated as a 300-position single pole switch.

In any given installation, individual program panels and their switches can be cascaded to get the desired number of characters in the final printout.

The programming unit contains a character matrix with single wire input for each character in the alphabet

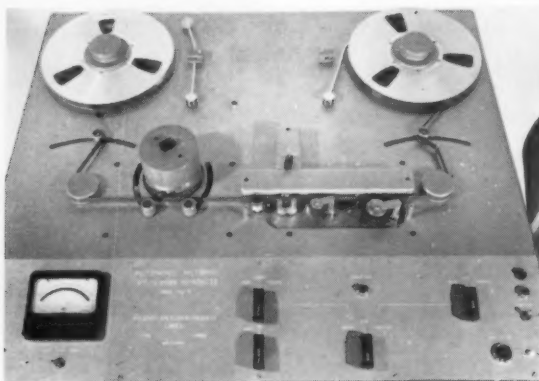
and for each figure, with corresponding 5-wire output in teletype code. This matrix provides the non-variable message content and format. Superimposed in the appropriate places are characters generated by the liquid level and temperature sensors (or other sensors).

The fixed portion of the message may be changed easily by altering the location of patch cords on the program panels.

A time clock and calendar date unit are included in the programming unit. In addition to providing pulses for the printout, the clock can be set to trigger the telemetering cycle at desired intervals. Since the actual printout may take only a few minutes each day, the teletype equipment is available for other company communications.

All power to operate the equipment (110 volts, 60 cps) is applied at the programming unit. Low voltage dc pulses are fed to the sensors at the oil tanks (or other locations) only during readout. Use of photoresistive coding and switching units avoids danger of arcing in hazardous locations.

Rotating head scans segments of magnetic tape for close analysis of information 102



One of the most interesting features of this magnetic tape scanner-reproducer is its ability to scan any chosen segment of tape for detailed analysis of the information it contains.

To do this, the tape is stopped in the desired position, then two capstans bring the tape segment into position around a revolving circular table. The table contains two diametrically opposed, multichannel heads which scan the segment of tape. Scanning can be done at any of three available speeds: 1 1/2, 15 or 120 ips.

Repeated scanning gives an output signal which is stable, permitting detailed analysis of the information.

Model TRS-73 magnetic tape scanner-reproducer was developed by Presentey Engineering Products Ltd., Ottawa, for use in geophysical work. It can also be used for other work, wherever information is recorded at the three speeds mentioned above.

Language laboratory offers versatile control features to teacher and students 103

Edwards of Canada Ltd., Owen Sound, Ont., has formed a new educational equipment division to market electronic teaching aids. They have designed a language laboratory which is now on the market.

From the master console, up to four separate lessons can be broadcast to any desired combination of student booths. Individual students can work independently, with advanced or remedial materials, yet still be under the teacher's control.

Dual-track tape recording and playback equipment, used throughout the system, eliminates the need for mass duplication and bulk erasing accessories. Students' dual-track tapes record master lesson material (programmed from the console) on the "lesson" track. Pupil responses are transcribed on the "practice" track.

Nerve centre of the new system is the instructor's console, housing lesson channel controls, student selector switches, amplifiers and tape playbacks. Each lesson channel in the console is fed by a separate tape playback.



Text presents statistical theory of communications clearly

Statistical Theory of Communication

Y. W. Lee; John Wiley & Sons, Inc., N.Y.; 1960; 508 pp.; \$16.75.

Anyone who has been privileged to attend Professor Lee's lectures on Statistical Communication Theory at M.I.T. during the past decade has been waiting for this book. Always a careful and able teacher, Dr. Lee has unhurriedly produced a text for his graduate course which will become a classic in this field because of its authority and exceptional clarity.

In statistical theory applied to communications, messages and noise are treated as random phenomena. The basic tools are probability theory and generalized harmonic analysis. The applications of the theory are to filtering, prediction and statistical estimation problems in communication and control systems.

The first half of the book presents the basic concepts. The most important of these is the generalization to random functions of the familiar harmonic analysis of communication and control theory. The discussions of the convolution integrals, correlation functions and power density spectra make generous use of graphical examples to emphasize the significance of the basic principles. There follows the pertinent elements of probability theory from density distributions, through ensembles of functions, averages, and characteristic functions, to the ergodic hypothesis. These results are used to find the correlation functions and power spectra of random processes analytically.

The second half of the book applies the basic tools to problems in measuring correlation and probability functions, and the use of the results in signal detection. Following a review of the fundamentals of linear systems, the statistical theory is used to design optimum systems for filtering and prediction according to the Wiener-Hopf technique. While the text is generally confined to stationery processes in linear systems, the concluding chapters on the use of orthonormal functions are obviously a preparation for modern non-linear work.

Throughout the book, the author adds heuristic reasoning, graphical examples, and experimental results where they will elucidate the theory. It is an excellent text and reference

for both research scientists and systems engineers. Dr. Lee was very recently made a Fellow of the I.R.E. "for contributions to communication theory and engineering education" both of which are exemplified by this outstanding book.

Reviewed by H. C. Ratz, Assistant Professor of Electrical Engineering, University of Saskatchewan.

Alternating Current Circuits

Russel M. Kerchner and George F. Corcoran; John Wiley & Sons, New York; Fourth edition; 662 pp; \$8.75

This book is one of the classic alternating-current circuits texts for a college curriculum. The authors intended it as an introduction to the subject for students of electrical engineering and physics. They have more than succeeded in their aim for it goes beyond an introduction to the subject and is also an excellent reference text for anyone interested in the analysis of electrical circuits.

Changes from the third edition are a new chapter I, Network Concepts, which deals with network variables, topology and duality. This brings the text in line with the modern practice of circuit notation in preparation for more advanced circuit analysis. The old chapter I is incorporated within Chapter II. Chapter X, A.C. Measurements, and Chapter XI, Determination of Circuit Parameters, have been left out of this edition, essentially to keep the book the same size as the third edition. Their deletion does not detract from the effectiveness of the book.

The term "phasor" has been adopted for a time varying quantity in place of the term "vector" as used in previous editions. Also the concepts of complex-frequency, and poles and zeros have been introduced in the chapters dealing with resonance and transient analysis.

For those who are not already familiar with the earlier editions of the text the chapter headings are: Network Concepts; Instantaneous Current, Voltage & Power; Effective Current and Voltage — Average Power; Phasor Algebra (As applied to A.C. Circuit Analysis); Sinusoidal Single-Phase Circuit Analysis; Non-Sinusoidal Waves; Coupled Circuits; Balanced Polyphase Circuits; Transmission Line Calculations; Electric

Wave Filters; Symmetrical Components; Power System Short-Circuit Calculations; Transient Conditions.

Each chapter has a number of problems with complete solutions and a number of problems within the chapter with answers given. In addition there is a good selection of problems at the end of each chapter.

Reviewed by J. T. Koski, Director of Electrical Technology, Ryerson Institute of Technology, Toronto.

Boolean Algebra and its Applications

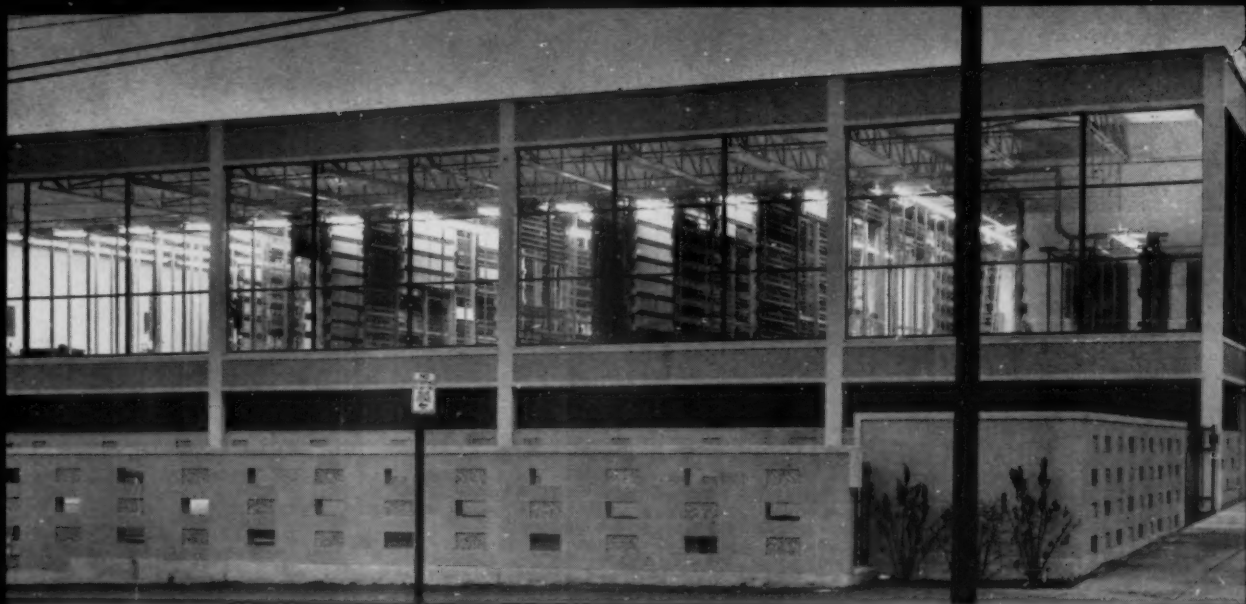
J. Eldon Whitesitt; Addison-Wesley Publishing Co., Inc., Reading, Mass.; 182 pp.; \$6.75.

The application of Boolean Algebra to computing systems using bistable electrical devices has engendered an interest in the subject far beyond that expected one hundred years ago, when logic was first treated symbolically. This text provides an unsophisticated introduction to the fundamental principles of Boolean Algebra, and shows how it is applied to the algebra of sets, symbolic logic, the algebra of propositions, and modern switching circuits. It is intended as a text in a short introductory course for students with limited mathematical background.

The fundamental principles of Boolean Algebra are introduced through the algebra of sets. The common laws are then applied to symbolic logic, and the truth method developed for propositions. The treatment of these subjects has the merit of using a notation which is common in the design of digital circuits. Since the latter comprises the chief application and occupies the second half of the book, the common notation emphasizes the similarities and the mathematical basis for the application to switching algebra. Relay circuits are used to illustrate the algebra and the analysis of time-sequence circuits. The attempt to demonstrate how digital circuits are used for arithmetic computation does not become more than an elementary introduction to the binary number system.

This book is well written and a person wishing to have a passing acquaintance with the subject could easily use it for self study. There are numerous interesting and well-selected problems throughout, with some answers. Each chapter closes with a short list of references from which there is conspicuously absent any mention of S.H. Caldwell's definitive work on Switching Circuits and Logical Design.

Reviewed by H. C. Ratz, Assistant Professor of Electrical Engineering, University of Saskatchewan.



Vancouver's new Castle telephone exchange has novel layout features. The distributing frame is below the equipment room, and the cable vault was eliminated by running cable to vertical potheads on the wall. From there, termination was made overhead to the frame. The exchange uses Strowger equipment supplied by Automatic Electric (Canada) Ltd.

What's new in view



Tokyo Shibaura Electric Co. is building this gamma field to test effects of radiation on plants. Gamma source will be installed on 6-meter tower in centre of field.



J. Baldwin, Deputy Minister of Transport, is shown inspecting a sample of cable aboard cable ship HMTS Alert. With him are F. W. H. Shaw, managing director, Submarine Cables Ltd., London (centre) and R. G. Griffiths, vice-president and chief engineer of Canadian Telecommunications Corp. The picture was taken during splicing of the shore end of the new trans-Atlantic multi-purpose telecommunications cable at Grosses Roches, Quebec.



New CFRB-FM antenna on Canadian Imperial Bank of Commerce, Toronto, gives 50 uv signal at radius of 70-80 miles. ERP is 200,000 watts.



Commonwealth Telecommunications Board members met recently in Ottawa. Seated are Hon. Leon Balcer, Canadian Minister of Transport, and Sir B. Barnett, chairman of CTB. Standing are W. Stubbs, sec. of CTB; J. R. Baldwin, Deputy Minister of Transport; D. F. Bowie, president of Canadian Overseas Telecommunications Corp.; Col. D. McMillan, U. K. representative of CTB.



Canadian Electrical Manufacturers Assoc. sponsored a training course in telecommunications and electronics for vocational teachers. On a plant tour, G. Richards, Toronto, and R. Smallwood, Charlottetown, met R. M. Robinson, Canadian General Electric Co.



New British Columbia firm, Videospection Ltd., provides underwater and underground inspection service. General manager G. W. H. Lawther checks underwater TV camera.



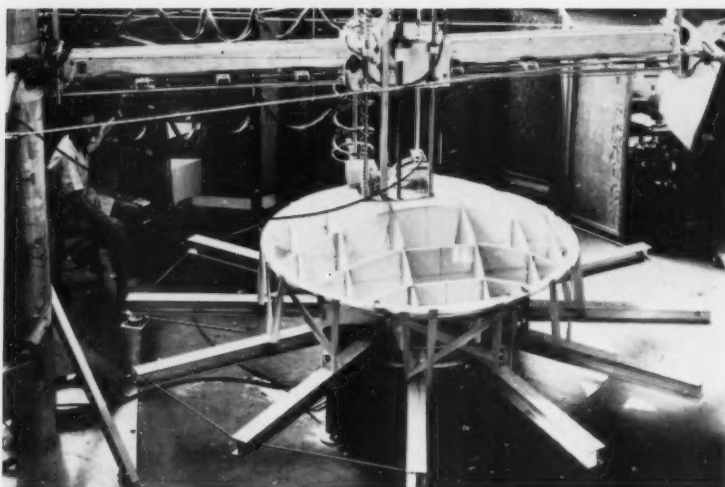
Short Bros. & Harland Ltd., Belfast, have developed AMY, (Automatic Monitor Yarn), to inspect linen yarns at rate of 1,800 feet per minute. It also analyzes the faults.

New components



New antenna uses rigid foam reflector 104

This new type antenna is composed of a lightweight rigid foam reflector and an antenna positioning device which can move the reflector through any angle of azimuth and elevation. In the left picture, the designer, M. Sulitaneanu, is shown pointing out the antenna's feed horn buried in its foam surface. The foam structure provides support for the



feed system.

The antenna positioning device uses linear motion to support and position the reflector. Twelve legs are long hydraulic cylinders grouped into four tripods. Coordinated changes in the length of the legs, controlled by a servomechanism, cause the antenna to move through any desired search or track pattern.

To fabricate a reflector, boards of styrofoam are joined together to form a cellular structure resembling an egg

crate divider. The reflector is then placed on a milling machine, as shown above. As the reflector revolves on a turntable, a high-speed cutter shapes the reflector to the desired parabolic contour. A computer controls the machine so that reflectors are shaped automatically to the desired size. The machine will handle reflectors from four to 20 feet in diameter.

Sylvania Electric (Canada) Ltd., Montreal.

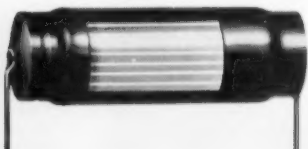
Hydraulic-magnetic time-delay relay 105

The Heinemann Electric Co. has developed a new hydraulic-magnetic time-delay relay with totally enclosed snap-action contacts. Called the type B, the new relay is capable of switching up to 5-amp loads, either spdt or dpdt. It has a continuous-duty coil. It does not have to be de-energized after each actuation, but can remain locked-in indefinitely. Available in 16 standard timings from 1/4 to 120 seconds, the type B can be supplied for either ac (60 cps) or dc operation. Standard ac voltages range from 6 to 240 volts; dc from 4 to 120 volts. Contact capacity is 5 amps at 125 or 250 vac; 5 amps at 30 vdc, resistive; 3 amps at 30 vdc inductive. Maximum power consumption is 2 watts ac; 3 watts dc.

D. T. Shaw, Montreal; F. D. Bolton Ltd. and Douglas Power Equipment Ltd., Vancouver.

Cadmium sulphide photocell 106

Type NSL-33 cadmium sulphide photoconductive cell has been designed for photometric applications, particularly where low light levels and low voltages are encountered. Spectral response ap-



proximates that of the human eye. Recommended illumination range is 0.01 to 1,000 foot candles. The tubular, hermetically sealed cell measures 0.378 inches in diameter and 1.25 inches long. A typical operating circuit involves a 1.34 volt battery and a meter movement.

National Semiconductors Ltd., Montreal.

Autotransformers 107

The series W Variac autotransformer line has been expanded to include 30-ampere units—type W30—in single and two- or three-gang combinations. They provide smooth, continuous, manual control of ac voltage from zero to 17% above input line voltage, and are available for either 120- or 240-volt, 50-60 cps operation. A high-silicon, low-loss material is used for the transformer core. Good thermal coupling between coil and base permits a high current rating. A basic uncased type is available for back-of-panel mounting and for installation in electrical equipment. A totally enclosed type (W30M) is also made for wall, bench, or back-of-panel mounting.

General Radio Co., Toronto.

Vertical sensing element 108

This electromagnetic vertical sensing element is a gravity-sensitive, liquid-damped pendulum device which can be applied to any vertical sensing situation requiring an electrical output. A jewel-suspended permeable mass acts as the variable reluctance portion of two orthogonally mounted differential transformers to provide a phase-sensitive output

signal proportional to tilt angle. Excitation is 3 volts (nominal) at 400 cps; voltage output is 78 mv $\pm 10\%$ at 30 arc minutes and 140 mv min. at 105 arc minutes; scale factor (typical) is 2.7 mv per arc minute up to 18 arc minutes.

Kearfott Div., General Precision, Inc., Little Falls, N.J.

Blac-Tac epoxy adhesive 109



Epoxy adhesive X61 has been developed with high initial tack strength. This allows nameplates to be bonded directly to equipment without clamping or use of screws. The resultant bond has high impact strength. Mixing ratio is equal parts of A and B, allowing simple handling in the shop.

Hysol (Canada) Ltd., Toronto.

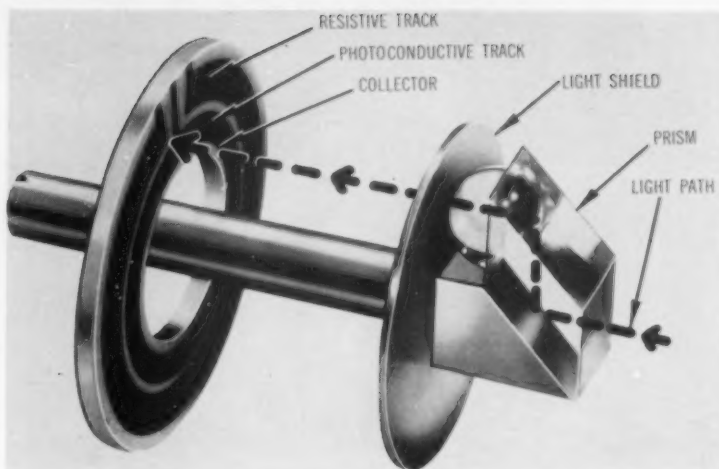
(continued on page 56)

New instruments

Electro-optical potentiometer 110

Betapot, a new potentiometer uses a light beam for pick-off, eliminating friction or contact noise. As shown in the illustration, a light beam is directed from a source along an axial path to a prism on the potentiometer shaft. The beam is deflected by a prism to strike an annular photoconductive track at a point determined by angular shaft position. High conduction set up by the light at the point where it strikes the photoconductive track completes a circuit between the collector and resistive rings.

Duncan Electronics, Costa Mesa, Cal.



Electronic counter 111

Lavoie Laboratories model LA-80 electronic counter features a directly coupled in-line readout. It utilizes a true decade system which makes binary conversion unnecessary. Time base stability is one part in 10^6 per day, count down time base dividers and self-contained provision for additional plug-in heads give the LA-80 broad capabilities for sophisticated applications. Basic frequency range is 10 cps to 10 Mc. Plug-in units are available for extended ranges. Decade outputs add the capability for oscilloscope calibration. Provision is made for a plug-in analog to digital counter unit which enables dc voltages to be read directly on the numerical indicator tubes.

Instronics Ltd., Stittsville, Ont.

Multipurpose electrometers 112

Two low-cost electrometers have been introduced which are useful also as dc pre-amplifiers and have outputs for driving oscilloscopes and recorders. Line-operated model 621 features 37 ranges; battery operated model 620 offers 31 ranges. Accessory voltage-divider probes are available to extend the voltage ranges to as high as 30 kv. Input impedances of both instruments can be selected from 10^6 to 10^{14} ohms to permit optimum balance of low circuit-loading versus minimum pickup.

Model 621 offers full scale current ranges of 10^{-11} to 10^{-4} ampere; model 620 covers from 10^{-11} to 10^{-5} ampere. Internal resistance measuring range of model 621 is 10^3 to 10^{11} ohms; range of model 620 is 10^5 to 10^{11} ohms full scale.

Keithly Instruments, Cleveland.

Two-pen recorder 113

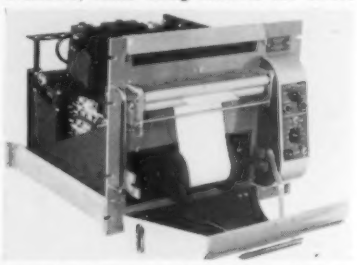
Esterline-Angus Instrument Co. has introduced a two-pen recorder in which the two pens simultaneously graph on a single chart any information which can be expressed as an electrical current or voltage. The two channels do not overlap on the 6-in. wide chart. The re-

order is available with an expanded scale for voltage ranges; that is, the portion of the chart on which voltage is recorded can be arranged so that the last 8 major dimensions of a 10 division chart will represent 40 volts out of a full scale of 140.

W. Hobson & Associates, Lachine, Que.; George M. Fraser Ltd., Toronto.

Direct reading galvanometer 114

New Electronic Products Ltd. direct writing galvanometer type 1185 provides up to 36 channels with 12-in. paper width and 21 speeds. The records, which are made with high frequency galvanometers, can be viewed directly due to the ultra-violet light source and the process-free photographic paper used. Interchangeable galvanometers of different frequency responses and sensitivities are available, some being suitable for direct



operation from strain gauges, thermocouples and other types of pickups without the use of amplifiers.

Radionics Ltd., Montreal.

DC voltage standard 115

A new dc voltage standard and null voltmeter has been developed by Kin Tel Div. of Cohu Electronics. Standard cell stability of model 302 is obtained through the use of a chopper circuit which constantly compares the output against an internal mercury-cadmium standard cell. Short term stability is better than 25 ppm and stability over a 30-day period is better than 50 ppm.

Voltage settings can be made in 1 millivolt increments. Up to 20 ma are available at any output from 1,000 to 502.110 volts. Resistance between the cabinet and either output lead is greater than 1,000 megohms. Effective output impedance is less than 0.01 ohms for dc; less than 0.2 ohms at 1,000 cps.

Atlas Instruments Corp., Toronto.

Smith chart impedance plotter 116

Dielectric Products Engineering Co. Smith chart impedance plotter provides instantaneous display of impedance as a continuous function of frequency in the 10 to 3000 Mc range. The plotter gives VSWR uncertainty as low as 1.01. The oscilloscope trace may be photographed, or an X-Y chart recorder may be used. Couplers, available in five models for ranges from 10 to 3000 Mc, employ two push-pull outputs for horizontal and vertical oscilloscope channels. Impedances at the coupler terminal may be read directly on the oscilloscope, and by rotating the faceplate, readings may be taken at all points along the output transmission line.

Dayrand Ltd., Montreal.

Instrument transformers 117

Model DO-5 is the latest addition to this line of doughnut instrument current transformers. Transformers are available with any primary rating from 50 amperes to 4000 amperes, and with 5 amperes or 1 ampere secondary. Standard models withstand a dielectric strength test of 2500 volts, but higher test potentials are available on order. Canadian Research Institute, Don Mills, Ont.

(continued on page 54)

To obtain further information about these products, use the reader service card on page 61



Isotope-powered weather station to be tested in Canada

The United States Weather Bureau, assisted by the Canadian Department of Transport, will test a new isotope-powered, automatic weather station in the Canadian Arctic.

Installation will be made this month at a remote, uninhabited island in the vicinity of Norwegian Bay, about mid-way between the joint Canadian-U.S. Arctic Weather Stations at Eureka and Resolute.

A dream of meteorologists for many years has been to obtain systematic weather observations from strategically-located remote areas. Unfortunately, many of the desired locations are relatively inaccessible and to establish manned stations would present such problems as recruiting isolation staff, and maintaining resupply operations.

The United States Atomic Energy Commission and the U.S. Weather Bureau spearheaded activity in the design and fabrication of an automatic weather station capable of functioning unattended for up to two years. Earlier difficulties created by lack of a continuous power source have been eliminated by the use of isotope power.

The station and the power source are housed in a cylindrical container, approximately eight feet long. The lower five feet will be buried in the permanently frozen ground.

Reliable and rugged meteorological instruments — an anemometer, thermometer and barometer — mounted as integral parts of the station will measure wind direction and speed,

temperature and barometric pressure. These readings will be fed into a data processing system and will emerge ready to go directly into the radio transmitter, which in turn will relay them every three hours to the receiving stations at Resolute and Alert. The anemometer and thermometer will be exposed on a tower beside the station, while the barometer will be placed within the cylinder along with recording equipment, radio transmitters, antenna and other electrical apparatus.

One of the station's unique features is the power source, located in the lower chamber of the container. Consisting of a Strontium-90 heat generator and thermocouples, batteries and a converter, it uses a safe insoluble chemical form of the isotope Strontium-90 securely locked in a corrosion-resistant capsule and shielded by three quarters of a ton of lead. The excess heat from the Strontium-90 is used to maintain an interior operating temperature of approximately 70 degrees Fahrenheit. This element produces thermo-energy to charge a nickel-cadmium storage battery system, which in turn activates the radio transmitter.

The isotope of Strontium-90 has a relatively long half-life and is capable of producing usable power for over ten years. The compound used, Strontium-titanate, is insoluble and biologically inert, with a melting point so high it could not be dispersed by the hottest gasoline fires.

The station was designed and built by the Nuclear Division of The Martin Co., Baltimore, for the Office of Isotope Development of the U.S. Atomic Energy Commission. In the photograph, technicians are shown lowering the power source into the buried cylinder for tests at Baltimore. Transmissions from Baltimore to Washington have been made since June of this year.

Canadian firms to exhibit at Los Angeles

The Department of Trade and Commerce is working closely with Canadian industry to promote export sales of Canadian products. At the Instrument-Automation Conference of the Instrument Society of America, which will be held in Los Angeles, Sept. 11-15, the department has reserved a large display area. Canadian firms have been invited to participate in an integrated exhibit, at nominal cost, by displaying their products and services.

This is a continuation of promotional assistance the department has been rendering with success.

Recommended practices on rotameters completed

The Instrument Society of America, Standards & Practices Dept., has developed a series of recommended practices dealing with variable area meters (rotameters).

Two intended additions to this series are ISA-RP16.5, "Installation, operation, maintenance instructions for glass tube variable area meters (rotameters)," and ISA-RP16.6, "Methods and equipment for calibration of variable area meters (rotameters)."

ISA would like to permit as broad an industry review as possible of these new practices before their publication. Draft copies are available to those interested in reviewing and commenting on them. Write to: L. N. Combs, E. I. duPont de Nemours & Co., Inc., Louviers Building, Newark, Delaware.

ISA recommended practices dealing with variable area meters already published are ISA-RP16.1, .2, .3, "Terminology, dimensions and safety practices for indicating variable area meters (rotameters)," and ISA-RP16.4, "Nomenclature and terminology for extension type variable area meters (rotameters)."

Copies of these recommended practices may be obtained from the Instrument Society of America, Publications Dept., Penn-Sheraton Hotel, 530 Wm. Penn Place, Pittsburgh 19, Pa. Price is 50c each to members of ISA; 75c to non-members.

a New and superior latching P&B relay



LIES FLAT FOR GREATER PACKAGE DENSITY, HIGHER PERFORMANCE



This DPDT, permanent magnet, latching relay is superior on these counts: (1) shorter height for maximum compactness between stacked circuit boards; (2) greater sensitivity (80 milliwatts); (3) better vibration resistance (30 g to 2000 cps); (4) better shock resistance (100 g).

Designated the FL Series, this relay meets all applicable sections of MIL-R-5757D, MIL-R-6106C and ABMA #PD-R-187.

Call your nearest P&B representative today for complete information about the whole P&B family of microminiature relays.

FL SERIES SPECIFICATIONS

Contact Arrangement: DPDT

Shock: 100 g for 11 milliseconds with no contact openings.

Vibration: .195; max. excursions, 10 to 55 cps, 30 g from 55 to 2000 cps. No contact openings.

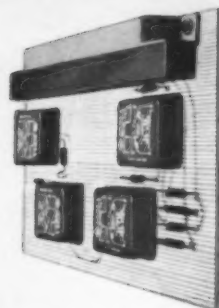
Linear Acceleration: 400 g minimum with no contact openings.

Pull-In: 150 milliwatts, approx. (standard) at 25°C. coil temperature.

80 milliwatts, approx. (sensitive) at 25°C. coil temperature

Operate Time: 3 milliseconds max. at nominal voltage at 25°C. coil temperature

Dimensions: .485" high, 1.100" long, .025" wide



Printed circuit board using 4 FL relays was designed by the Martin Company, Orlando, as part of ground support equipment for a major missile project.

THERE'S A **P&B**
CRYSTAL CASE RELAY
FOR YOUR PROJECT

Diode in relay case is used for arc suppression in special applications. Four diodes form full-wave bridge rectifier for 400 cycles.



Non-latching or latching relays in conventional crystal cases with or without shoulder brackets, studs or mounting plates. All types of terminals are available.

Terminals spaced on .200" grids are available on all P&B microminiature relays. These carry a "G" suffix (SCG and SLG) and are .890" high, .800" wide, .400" deep, max.

These 3 relays are shown slightly reduced in size.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONICS PARTS DISTRIBUTOR



POTTER & BRUMFIELD

DIVISION OF AMF CANADA LIMITED • OXFORD STREET, GUELPH, ONTARIO

Reports—continued

Representatives and principals

Len Finkler Ltd., Toronto, has been appointed Canadian sales representative by **American Electrical Heater Co.**, Detroit, Mich. (soldering irons and accessories).

Wackid Radio Television Labs. Ltd., Ottawa, is now a stocking distributor for **Cambridge Thermionic Corp.**, Cambridge, Mass. (Cambion electronic components and hardware).

RF Products, a division of Amphenol-Borg Electronics Corp., Broadview, Ill., has granted exclusive rights to manufacture and sell its products in Canada to Amphenol Canada Ltd., Toronto, a licensee of the U. S. company. The products concerned (coaxial connectors, switches and cable) were formerly handled in Canada by The Glendon Co. Ltd., Toronto, on an import basis.

Precision Paper Tube Co., Chicago, Ill., has appointed The Glendon Co. Ltd. as exclusive agents in Canada (square and rectangular paper tubes; round, square and rectangular bobbins; Resinite phenolic impregnated tubing and coil forms).

W. Hobson & Associates, Lachine, Que., has been appointed sales representative in eastern Canada by **Associated Research, Inc.**, Chicago, Ill. (insulation test instruments).

Edo (Canada) Ltd., Cornwall, Ont., has appointed A. Deskin Sales Co., Montreal, as its sales representative in Ontario, Quebec and the Maritimes

Agents and lines wanted

CEE has made it a policy to publish all announcements received regarding the appointment of Canadian sales representatives or distributors by manufacturers of electronic and allied components, instruments and equipment.

This service is now being extended to provide even greater benefit to electronics firms. Manufacturers who wish to find suitable sales representatives or distributors in Canada, and established representatives who are seeking additional lines, are invited to submit brief statements of their requirements to the editor at 481 University Avenue, Toronto 2, Ontario.

These will be published in this space as a free editorial service.

for the Burnell line of products which Edo manufactures and sells under exclusive franchise (filter networks and delay lines).

Douglas Randall (Canada) Ltd., Scarborough, Ont., has become sales agents in Canada for **Beede Electrical Instrument Co.**, Pennacook, N.H. (ammeters and voltmeters); **Columbus Electric Mfg. Co.**, Columbus, Ohio (snap-action and rotary switches, furnace controls); **ECCO Electronic Components Corp.**, Yonkers, N.Y. (BNC, TNC and constant impedance plugs and sockets; telephone plugs, jacks and patch cords); **Pickard & Burns, Inc.**, Needham, Mass. (precision frequency and time comparators, temperature monitoring equipment); **Shepherd Industries, Inc.**, Nutley, N.J. (magnetic recording heads, tape transports, magnetic storage drums); **Wayne George Corp.**, Boston, Mass. (Digisyn photoelectric shaft position encoders, digitizers and displays, digital position transducers).

Pyramid Instrument Corp., Lynbrook, N.Y., represented in Canada by Atlas Radio Corp. Ltd., Toronto, has changed its name to **Amprobe Instrument Corp.** (Amprobe clamp-on volt-ammeters, cable tracers, Remcon remote control lighting systems).

New company formed to handle component lines

R. B. Finkle, formerly marketing manager for electronic components and special products in the Electronic Tube and Components Division of Canadian Marconi Company, has formed a new company named **Tri-Tel Associates Ltd.** at 81 Sheppard Ave. W., Willowdale, Ont. (Tel: BA 2-2529). Tri-Tel is now exclusive Canadian representative for the following lines formerly handled by CMC:

Clarostat resistors and potentiometers; Esico soldering irons; Fisher hi-fi components; Jackson test equipment; National receivers and parts; Rogers flybacks, yokes and coils; and Turner microphones.

Associated with Mr. Finkle are E. Boyden and J. A. (Joe) McCormick. J. M. (Jack) Nelson of Vancouver is representing the lines in western Canada for Tri-Tel Associates.

CN/CP Telex network includes more Canadian centres

Telex, the automatic dial teletypewriter service operated jointly across Canada by Canadian National-Canadian Pacific Telecommunications, is now available in Cornwall, Ont.; Grande Prairie, Alta.; Dawson Creek and Fort St. John, B.C.

Expansion of the network further up the Alaska Highway to either Fort Nelson, B.C. or Whitehorse, Yukon Territory is expected later this year.

Ottawa report—cont.

among the industrialized nations of the Free World.

About half the nations of Europe have a flat embargo on imports of almost all types of Japanese goods. Britain accepts considerable quantities from Commonwealth countries such as Hong Kong and India but little from Japan. The United States accepts goods from all countries but by comparison far less than Canada.

Political overtones to this program are that if under-developed countries cannot find markets in the West they will inevitably turn to the Communist bloc. (The attraction of the vast Chinese market for Japan is a case in point.)

First discussion of this problem was at the 1958 Commonwealth Economic Conference in Montreal where delegates resolved to seek ways to find assured markets for the secondary manufacturers of underdeveloped countries. Loans to poorer countries are self-defeating if goods produced by industries built on foreign capital were frozen out of the markets of Europe and North America, they felt.

Canadian pressure in Washington and the capitals of Europe resulted in a London meeting attended by officials from Canada, Britain, the U. S. and Hong Kong.

This was to be followed in July by a ministerial conference to discuss specifically the problem of textile products from low-wage countries.

The problem has particular relevance for Canada since Finance Minister Fleming announced recently the 1961 quotas for a wide-range of Japanese imports. In most cases these "voluntary" quotas were no higher than for 1960, representing a smaller share of a larger market. On stainless steel flatware they were considerably smaller.

These concessions on products such as made-up textiles, electronic tubes, transistor radios, plywood, rubber footwear, raincoats and buttons, were only reached after months of hard bargaining. The Japanese government made it clear it would press for increases next year.

Mr. Fleming said in a recent Toronto speech that the problem of Hong Kong imports is receiving continuing study. However, sources say no action will be taken until the results of the international meetings are assessed. Any action would have to be taken unilaterally by Canada since the Hong Kong government says it is unable to police all its own exports.

Canadian conference will host group of university students

As in previous years, the IRE Canadian Electronics Conference Executive has established plans to bring a group of student members to Toronto for the meetings, Aug. 2-4.

One member from each Student, or Student Associate Branch in Canada will be invited to attend as a guest of the IRE. While in Toronto, they will be able to attend the technical sessions and tour the exhibits at the Automotive building.

In addition, the Conference Executives have asked the Toronto Section to organize two tours for the students. Preliminary plans have been made to take the students around the engineering laboratories at the University of Toronto, and through some of the control rooms of the Toronto Hydro-Electric System.

More companies take IRE exhibit space

Sales of exhibit space at the IRE Canadian Electronics Conference continue to be brisk. At the present pace, space will be completely sold out by show time this year.

These companies have signed up since the preliminary list of exhibitors was published in the July issue of CEE:

Amalgamated Electric Corp.; Avro Aircraft Ltd.; Behlman Engrg. Co.; Croven Ltd.; Cushing & Nevell Ltd.; Delevan Electronics Corp.; Electro Instruments; Electromechanical Prods.; Electronic Research & Dev. Co.; Etelco (Canada) Ltd.; Hewlett-Packard Co.; Hexacon Electric Co.; Kay Electric Co.; Keithley Instr. Inc.; Kemet Co.; Kistler Instr. Co.; Litton Systems (Canada) Ltd.; Mel Sales Ltd.; Multitone Electronics Ltd.; R. D. F. Corp.; Sensitive Research Instr. Corp.; Tele-Radio Systems Ltd.; Tenney Engrg. Inc.; Vitro Corp.

Toronto plans PGMITT/PGAP group

A number of members in the Toronto Section have expressed interest in forming a composite Professional Group Chapter on Microwave Theory & Techniques, and Antennas & Propagation. The possibility of forming such a group was discussed at the last meeting of the Toronto executive, and it was decided to conduct a survey among members.

Anyone interested in such a chapter should contact Dr. J. L. Yen,

Electrical Engineering Dept., University of Toronto, Toronto 5.

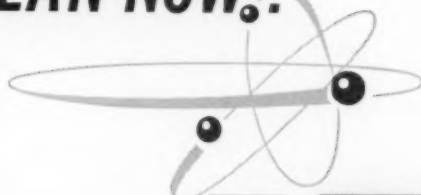
A meeting to discuss the proposed chapter will be held in Toronto, September 25. It will be the second meeting of the 1961-62 season for the Toronto Section and the technical paper will be appropriate to the occasion.

Vancouver Section elects officers

The Vancouver Section of the Institute of Radio Engineers held its annual banquet and election of officers May 15. Elected to the position of Chairman of the Section was Herbert A. Hoyles, a member of the firm of Hoyles, Niblock and Associates.

Elected to the Executive Committee as Vice Chairman was Mr. D. Hugh Kay, President, Research Industries Limited, and as Secretary-Treasurer, Mr. Thurb D. Cushing, Vice-President, Engineering, Lenkurt Electric Company of Canada Ltd.

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Defence contracts

Unclassified electronics contracts for \$10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parentheses indicates the number of contracts, the amount being the total value.

May 16-31, 1961

- ▶ Ampex of Canada Ltd., Ottawa, recorder/reproducers, \$33,816.
- ▶ Beckman Instruments, Inc., Toronto, refurbishing and/or lubrication of potentiometers, \$10,000.
- ▶ Bell Telephone Co. of Canada, Ottawa, installation of telecommunication equipment, \$52,959.
- ▶ Canadian Marconi Co., Montreal, traveling wave tubes, \$71,213; technical representatives, \$17,870.
- ▶ Canadian Westinghouse Co. Ltd., Ottawa, armament spares, \$15,456.
- ▶ Carriere and MacFeeters Ltd., Scarborough, Ont., repair and overhaul of ground rectifiers and auxiliary generating sets, \$15,000.
- ▶ Collins Radio Co. of Canada Ltd., Toronto, technical rep., \$10,306.
- ▶ Computing Devices of Canada Ltd., Ottawa, repair and overhaul of electrical/electronic equipment, \$40,990.
- ▶ Fleet Mfg. Ltd., Fort Erie, Ont., sonar hull units, \$410,093.
- ▶ Garrett Mfg. Ltd., Rexdale, Ont., technical reps., \$44,038.
- ▶ Gen-Tec Ltd., Quebec City, data reduction and computing services, \$15,000.
- ▶ Samuel C. Hooker (Canada) Ltd., Montreal, oscillators, \$13,580.
- ▶ ITT Electronics Service Co. of Canada Ltd., Town of Mount Royal, Que., services of calibration team, \$83,695 (2).
- ▶ Lake Engrg. Co. Ltd., Scarborough, Ont., tubes, \$10,776.
- ▶ Marsland Precision Equipment Ltd., Waterloo, Ont., components, \$17,405.
- ▶ Northern Telephone Ltd., New Liskeard, Ont., installation of telecommunication equipment, \$519,258 (4).
- ▶ Remington Rand Ltd., Ottawa, rental and service of office equipment, \$140,400.

June 1-15, 1961

- ▶ Ahearn & Soper Co. Ltd., Ottawa, radiation detection equipment, \$83,164.
- ▶ Atlas Instrument Corp. Ltd., Toronto, signal generators, \$20,617.
- ▶ Aviation Electric Ltd., Montreal, vertical gyro assembly, \$12,668.
- ▶ Bell Telephone Co. of Canada, Ottawa, lease of communication circuits, \$96,351 (3).
- ▶ British Columbia Telephone Co., Vancouver, lease of communication circuits, \$974,943 (8).
- ▶ Canadian Aviation Electronics Ltd., Montreal, rental of calibration laboratory and personnel, \$126,956 (2).
- ▶ Canadian Marconi Co., Montreal, magnetrons, \$54,113.
- ▶ Canadian Westinghouse Co. Ltd., Ottawa, tubes, \$169,930.

- ▶ Canadian Westinghouse Co. Ltd., Hamilton, technical reps., \$115,295.
- ▶ Allan Crawford Associates Ltd., Wiltondale, Ont., voltmeters, \$11,278.
- ▶ E.M.I.-Cossor Electronics Ltd., Dartmouth, technical reps., \$75,000.
- ▶ Anthony Foster & Sons Ltd., Toronto, electronic equipment, \$14,999.
- ▶ Gen-Tec Ltd., Quebec City, repair and overhaul of electronic equipment, \$90,500.
- ▶ Instronics Ltd., Stittsville, Ont., typewriter test sets, \$16,336.
- ▶ International Business Machines Co. Ltd., Ottawa, Rental of office machines and equipment, \$233,794 (6); computation services, \$20,000.
- ▶ E. G. Lomas, Ottawa, components, \$36,289.
- ▶ Mel Sales Ltd., Toronto, signal generators, \$11,342.
- ▶ Muirhead Instruments Ltd., Stratford, Ont., components, \$12,458.
- ▶ Northern Electric Co. Ltd., Ottawa, teletype spares, \$16,772.
- ▶ RCA Victor Co. Ltd., Montreal, tubes, \$15,298.
- ▶ Raytheon Canada Ltd., Waterloo, Ont., tubes, \$24,643.
- ▶ Redifon Canada, Montreal, technical representatives, \$61,965.
- ▶ Sylvania Electric (Canada) Ltd., Montreal, tubes, \$11,304.
- ▶ T.M.C. (Canada) Ltd., Ottawa, spares for transmitter, \$11,108.
- ▶ Thermo Electric (Canada) Ltd., Brampton, Ont., thermocouples, \$23,239.

June 16-30, 1961

- ▶ Atlas Instrument Corp. Ltd., Toronto, components, \$12,220.
- ▶ Aviation Electric Ltd., Montreal, navigational sets for land vehicles, \$708,710.
- ▶ Bayly Engineering Ltd., Ottawa, multi-meters, \$16,160.
- ▶ British Columbia Telephone Co., Vancouver, lease of communication circuits, \$65,041 (2).
- ▶ Canadian Arsenals Ltd., Ottawa, tests and related services on electronic parts and materials, \$135,000.
- ▶ Canadian General Electric Co. Ltd., Toronto, modification kits, \$20,163.
- ▶ Canadian Marconi Co., Montreal, magnetrons, \$56,569.
- ▶ Canadian National Railway Co., Ottawa, lease of communication circuits, \$87,648.
- ▶ Chibougamau Telephone Ltd., Montreal, installation of telecommunication equipment and associated on-base cabling, \$180,876.
- ▶ Computing Devices of Canada Ltd., Ottawa, repair and overhaul of electrical/electronic equipment, \$45,920.
- ▶ Electrodesign Ltd., Montreal, electrical dummy load, \$23,875.
- ▶ Garrett Mfg. Ltd., Rexdale, Ont., repair and overhaul of electrical/electronic equipment, \$40,371.
- ▶ Hydro-Electric Power Commission of Ontario, Toronto, test samples, tests and related services on electronic parts and materials, \$562,000.
- ▶ Ontario Northland Communications, North Bay, Ont., installation of telecommunication equipment, \$105,681.
- ▶ Philco Corp. of Canada Ltd., Don

Mills, Ont., technical representative, \$11,262.

- ▶ RCA Victor Co. Ltd., Montreal, supply and installation of transmitter, \$186,240; control room equipment, \$20,000.
- ▶ Sperry Gyroscope Co. of Canada Ltd., Montreal, aircraft instruments, \$138,680; tubes, \$13,018.
- ▶ Varian Associates of Canada Ltd., Georgetown, Ont., tubes, \$22,378.

CAMESA News

This bulletin has been prepared for CEE by the Approvals and Specifications Divisions, Canadian Military Electronics Standards Agency.

▶ CAMESA has been advised by the Armed Services Electro-Standards Agency that publication ASEA 51-4, Application and Design Notes (Electronic Components), is obsolete. Future amendments and reprints are not anticipated. Holders of ASEA 51-4 who wish to retain their copy for information purposes are cautioned that the data contained therein may not be current. Application and design information will be supplied in Military Standard format in future. Such military standards will be distributed by CAMESA as they become available.

▶ Amendment 2 dated February 13, 1961 to Specification MIL-R-26C, covering fixed wirewound power resistors, adds styles RW67, 68 and 69 which are insulated versions of styles RW57, 58 and 59. This amendment also increases the maximum resistance to the next higher value for each style in the specification (where applicable), to conform with the 24-value series decade of MS-90178. The amendment became effective August 1.

▶ Specification MIL-C-26518B(USAF), covering miniature environment-resisting rack and panel connectors designed for 200 C ambient temperature operation, has recently been approved by the Canadian Armed Forces. Previous versions of this specification were not adopted for Canadian procurement. A similar specification, MIL - C - 26500A(USAF), covering miniature circular environment-resisting connectors designed for 200 C ambient temperature, has also been approved by the Canadian Armed Forces. It contains many modifications over MIL-C-26500(USAF), which it supersedes.

▶ For those electronic part manufacturers and others who are interested in environmental test facilities, CAMESA has available copies of a paper by Mr. E. W. Parrott entitled "Government and Industry Requirements for Test Facilities." This paper provides a general description of environmental test equipment with relative costs, performance capabilities, and notes on practical usage.

People—continued

Campbell Lewis Gardner has been appointed sales manager for Schenectady Varnish Canada Ltd.

Mr. Gardner joined Schenectady Varnish Canada in 1957 as a technical sales representative for the complete line of electrical insulating varnishes and industrial resins. In his new position he will direct and coordinate sales and marketing for the company in Ontario and Quebec.

Andrew J. Lipinski has joined Lenkurt Electric Co., Inc., California, as a product planning staff member.

The Polish-born scientist has been with Canadian Westinghouse Co. Ltd., Hamilton, since 1953. His last position there was as manager of general communications engineering dept. From 1947 to 1953, he was an engineer in microwave development at Standard Telecommunications Laboratories, Enfield, England.

Mr. Lipinski earned a diploma from the Imperial College of Science and Technology, London, and received his BSc degree from the City and Guilds College, one of three divisions of Imperial College.



Lipinski



Moore

Donald W. Moore has been appointed director of engineering for the ESCO Facility of Electronic Specialty Co., Los Angeles.

Mr. Moore is a graduate of the University of British Columbia. He spent three years with Canadian General Electric Co. Ltd., commencing with the electronics training course at Electronic Equipment and Tube Dept., Toronto.

A. C. Lucas has been appointed representative for Mel Sales Ltd. in B.C. and Alberta.

Mr. Lucas has been associated with the electronics industry in western Canada for a number of years. He will handle the sale of instruments for Mel Sales Ltd., and components for Melcom. His office is located at 911 Anderson Cr., West Vancouver. Telephone: WA 2-7752.

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Electric field plotter 118

Electric field plotter model P103A is a self-contained device for the solution by rheo-electrical analogy, of problems involving the Laplace field equation, such as those relating to heat and fluid flow and electrostatic or magnetic fields. The plotter consists of a flat plotting board with built-in bridge unit and power supply, centre-zero balance meter, and controls. To use the plotter, conductive paper is placed on the plotting area and the subject under investigation is simulated by low-resistance conductors painted on the paper.



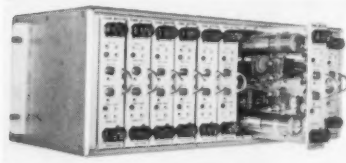
Boundary potentials and up to five intermediate forcing potentials are set up by individual ten-turn potentiometers. These potentials are applied through suitably terminated leads to the conductive elements to establish a two-dimensional electrical analogy of the physical subject and associated field patterns. A

stylus connected to a high-resolution null-balancing circuit in the bridge unit is used in conjunction with the balance meter to explore the conductive paper surface. In this way electric field contours can be investigated and plotted to represent their physical counterparts.

George Kelk Ltd., Don Mills, Ont.

Microwave carrier 119

Transistorized microwave carrier system MX-106 handles 600 voice channels whose quality meets or exceeds toll circuit requirements. An initial low channel density system can be expanded at any time. The system uses frequency division principles with single sideband



suppressed carrier techniques. Frequency allocations, sideband allotment, and carrier levels are compatible with Collins MX-103 carrier, Western Electric L-type carrier, CCITT and others. All active components affecting the signal path are semiconductors and circuits are printed on card modems that plug into special rack-mounted card cages, 12 modems to the cage. Standby features of the system include 100% backup of any equipment common to 12 or more channels.

Collins Radio Co. of Canada Ltd., Toronto.

Broadband amplifier 120

Pacemaker broadband amplifier has a minimum gain of 35 db on low band and high band television frequencies, and a minimum gain of 30 db on FM frequencies 88-108 Mc. There are separate inputs for high band and low band/FM, with provision to combine inputs for common input. Output is 2 volts total of all carriers on low band/FM, and 2 volts total of all carriers on high band. Intermodulation distortion is 40 db down.

Benco Television Associates Ltd., Rexdale, Ont.

Industrial temperature control 121

This low-cost, thermocouple-operated, potentiometer controller is designed for a wide variety of temperature control operations. Heart of the system is a transistorized amplifier-relay panel containing all necessary operating controls and circuitry. Temperature is sensed through a thermocouple, and control is possible with resistances of as much as 20 ohms in the lead wire. Temperatures from -200°F to -2000°F can be controlled to within 4 degrees. A time proportioning unit prevents temperature over-shoot.

Honeywell Controls Ltd., Toronto.

Voice actuated recorder 122

Westrex type RA-1651 signal-actuated voice recorder has been designed for voice communications systems which must maintain a complete and accurate log of messages, such as air traffic control. The recorder can operate continuously for 25½ hours without a change of reels if the slowest speed of ½ ips is chosen. Other speeds are available. The unit begins recording within 10 milliseconds after a voice signal is detected and a time stamp automatically stamps the time and date at the end of the message. If continuous operation is selected by switch, the time is automatically stamped every minute.

Tele-Radio Systems Ltd., Toronto.

High-speed printer 123

Numerical reports and documents can now be printed at speeds up to 1,285 lines per minute by the IBM 1403 printer. Two new optional features enable the 1403 to print numbers at more than double its 600-lines-per-minute alphanumeric printing rate. The first feature, interchangeable chain-cartridge adapter, enables the operator to change quickly from one type size,

type style, or special character arrangement to another. The second feature, numerical print, more than doubles the output potential of the printer when preparing reports, such as transit listings and others which can be limited to numbers only.

International Business Machines Ltd., Toronto.

Electronic secretary 124

A new telephone answering set has been developed by Electronic Secretary Industries, Inc. The tape-operated Model LP (long play) will record incoming messages of varied lengths up to one hour's duration (two-hour capacity also available). The unit, which connects to a telephone line, utilizes transistors to provide low power consumption and ease of maintenance. A "time out" device allows automatic disconnect if the caller remains silent for as long as 12 seconds. Electronic Secretary is designed to provide telephone answering facilities for small business firms and individuals.

Automatic Electric Sales (Canada) Ltd., Toronto.

Voice repeater for telephony 125

A fully transistorized two-wire voice frequency negative impedance repeater of the series-shunt type, has been introduced. Suited for use as an intermediate or terminal repeater on trunk circuits or subscriber telephone lines, the equipment can be used on loaded and non-loaded cable pairs, open-wire lines, side and phantom circuits, compound circuits, and other types of voice frequency circuits. All functional units of each repeater are housed in an airtight container, and all are of standard uniform dimensions. The repeater units are mounted on a 4½ x 18½ in. pre-wired panel, eight repeaters to a bank, by means of a plug-in socket.

Removing a unit does not cause an interruption in the transmission circuit due to special switching-through facilities.

Philips Electronics Industries Ltd., Toronto.

Ultrasonic cleaning equipment 126

Ultrasonics Corp. has introduced a new configuration of cleaning equipment for use in small parts production and in research laboratories. In the new units, high power is applied simultaneously to three or more containers. In a production process, each container can be filled with a different fluid so that small parts can be successively washed, rinsed, and final rinsed. In laboratory applications, the unit may be used for simultaneously observing the effect of ultrasonic energy on different materials.

Ultrasonics Corp., Los Angeles.

Static-magnetic dc power supplies 127

The static-magnetic system, already proved as an economical means of obtaining good regulation in a simple, reliable circuit, has been used in a new standard line of CVQ power supplies. Shunt-type transistor control has been added to provide a much closer regulation of the dc output voltage. Control of the dc output voltage becomes a precise closed-loop or feedback form of regulation.

Sola-Basic Products Ltd., Toronto.

Tape-controlled system measures parts 128

The Sheffield Universal 5-axis numerical tape controlled measuring machine, model TC-101 is capable of inside, outside and thickness measurements of parts of any shape. The system



simultaneously measures the inside and outside dimensions or the contour or a part, determines wall thickness, and prints the results as well as providing visual readout. It positions and measures the positions of the electronic gaging styli at any point or angle to within 1/10,000 of an inch in the gaging range of 20 inches in length and height. Wall thickness is measured to an accuracy of 50 millionths of an inch.

A. C. Wickman Ltd., Toronto.

(Continued on page 56)

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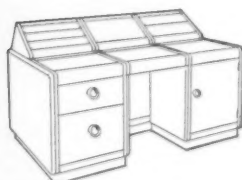
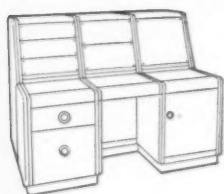
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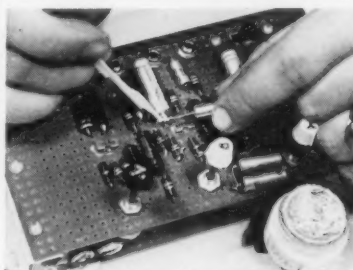
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New components—cont.

Epoxy silver solder

129

This silver conductive epoxy solder has a resistivity approaching the resistance of metals—between 0.01 and 0.0001 ohm-centimeters. It can be used



at low temperatures for components which are heat sensitive and it has no flux or residue to contaminate sensitive electronic components. Epoxy solder is available in two paste forms—a one-component heat curing paste and a two-component room temperature curing paste. Shear strength of a steel-to-steel bond is 3200 psi.

E. S. Gould Sales Co., Montreal.

Switch uses mercury jet commutator

130

A new series of mechanical commutating switches known as the Delta-switch model 210 is offered in one-pole and multi-pole configurations for commutation of 64 and 100 channels of information. Designed for 20 cps operation, these switches are available with or without 1200 rpm, 115 vac, 60 cps synchronous hysteresis drive motors. A jet of mercury replaces the conventional wiper arm for commutation, assuring long, trouble-free operation. The switch



can be overhauled inexpensively by cleaning the mechanical parts and replacing the mercury.

Advanced Technology Laboratories, Mountain View, Calif.

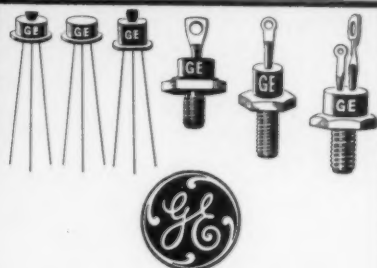
Miniature trimmers

131

Two new miniature trimmers with resistances ranging to 20 k have been introduced by Spectrol Electronics. Model 80-3-2 is 1/3-in. diameter and has a 10-32 threaded bushing for panel mounting. Model 80-3-3 has a 3/8-in. x 32

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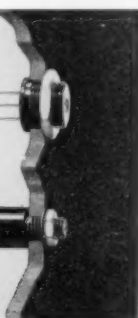
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threaded case and mounts within the panel with very little projection front or rear. Resistance range is 50 ohms to 20 k; tolerance is $\pm 5.0\%$; noise is 100 ohms ENR max.; power rating is 1 watt at 50 C.

Whittaker Electronics Ltd., Ottawa.

MODEL 80-3-3
Threaded Case Type

MODEL 80-3-2
Threaded Bushing Type



Low ringing filter **132**

The new Burnell LTR-1, low transient response filter is being manufactured in Canada by Edo (Canada) Ltd. The filter combines centre frequency, band width, rise time and attenuation characteristics to insure minimal phase distortion and low transient response. It exceeds performance standards for MIL-F 18827A. Centre frequency is 400 cps; phase band width (3 db down) is 20—16.5% of centre frequency; attenuation is 30 db at half and twice centre frequency; over-

shoot (low ringing) is 1%; rise time (1% to 99%) is 6.25 m-sec; insertion loss is less than 2 db when input is 1,000 ohms and output is 6,000 ohms.

Edo (Canada) Ltd., Cornwall, Ont.

Linear crystal discriminator **133**

Electronic Laboratories Corp. crystal discriminator CD-106B uses two crystals in a package configuration measuring only 1.000x1.250x0.750 inches. With a centre frequency of 10.7 Mc and good linearity over a range of ± 5.0 kc, distortion is held to less than 1.5%. DC zero adjustment within ± 3.0 kc does not affect linearity. The discriminator provides an output level of 2 v p-p over ± 5.0 kc for common design conditions and operates throughout an ambient temperature range of -55 C to $+85$ C.

David R. Beattie, Toronto.

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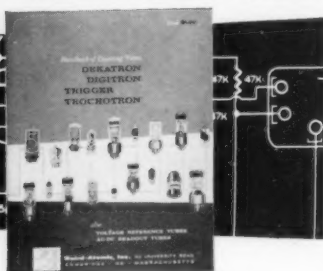
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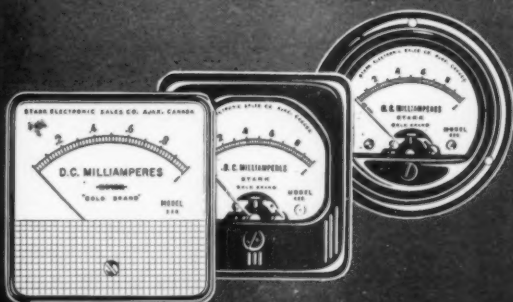
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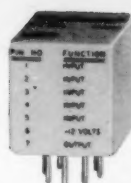
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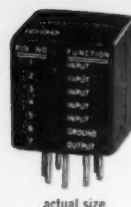
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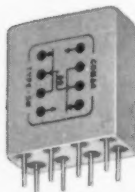
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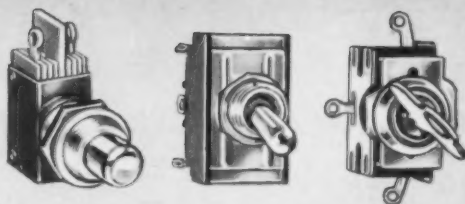
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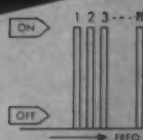
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Presidents' Professional Assoc. will assist top management

A non-profit organization, the Presidents' Professional Association, has been established to assist chief executives in the performance of their responsibilities as top management.

An affiliate of the American Management Association, the new group will be guided by a planning council composed of chief executive officers of 43 companies with assets ranging from \$3 million to more than \$2 billion.

One of the interesting features of the planning council is the number of representatives from the electronics industry. Two of them are Canadians: S. M. Finlayson, president of Canadian Marconi Co., and E. W. Leaver, president of Electronic Associates Ltd.

Other council members include R. J. Cannon, president of Cannon Electric Co.; J. E. Jonsson, chairman of the board, Texas Instruments; R. E. Lewis, president of Perkin-Elmer Corp.; D. G. Mitchell, vice-chairman of the board, General Telephone & Electronics; R. E. Olson, president of Taylor Instrument Companies; D. Packard, president of Hewlett-Packard; P. B. Wishart, president of Minneapolis-Honeywell Regulator Co.

Hi-Fi Association to hold exposition

The Dominion High Fidelity Association is making preparations for its exposition to be held in Toronto's Seaway Hotel, October 18-21. Exhibits will be displayed in individual rooms, permitting effective demonstrations of the audio equipment.

The quality of equipment shown this year should be better than ever before. The Qualifications Committee of the Association has set minimum standards of performance which equipment must meet before being admitted for demonstration. While the standards have been in existence before, they have recently been raised to ensure better performance for the buying public attending the exposition.

APEO accredits new engineering courses

An additional 14 engineering degree courses have been accredited by the Association of Professional Engineers of Ontario for teaching at four Ontario universities, it was announced here today by T. M. Medland, execu-

tive director.

The universities and their new courses are: Carleton University, Ottawa; civil, electrical, mechanical engineering, and engineering physics.

Essex College of Assumption University, Windsor; civil, chemical, electrical and mechanical engineering, and the metallurgy option in engineering physics.

McMaster University, Hamilton; chemical, electrical and mechanical engineering, and engineering physics. University of Toronto; industrial engineering.

There are now seven universities in Ontario teaching accredited engineering courses.

Wholesalers plan code of ethics

At the sixth annual meeting and convention of the Canadian Electronic Wholesalers' Association, held at Jasper Park Lodge, July 3-5, a committee was appointed to consider and bring in a code of ethics for adoption at the 1962 annual meeting. The 1962 meeting will be held in Toronto, April 16-17.

Elections were held during the Jasper meetings and resulted in bringing in the following officers: Chairman of the board is A. M. Clark, Western Agencies, Vancouver; President is A. G. Johnson, Johnson Electric Supply, North Bay; Vice-president is C. G. Mann, Cam Gard Supply, Winnipeg.

DOT takes over navigator stations

The take-over by the Department of Transport from Computing Devices of Canada Ltd., of operational control of four Decca Navigator stations in Eastern Canada will be completed within weeks.

The transfer of operations of the Nova Scotia chain was completed July 2 and the transfer of the two chains on the East and West coasts of Newfoundland is in progress.

The fourth chain is being moved from Quebec City, where it covered the lower St. Lawrence river, to Anticosti Island, to cover the Gulf of St. Lawrence. This station is due to be on the air by fall.

All four chains comprise a master and two slave stations.

A spokesman for the Department of Transport said consideration is

being given to installation of a fifth, limited, chain to cover the Straits of Belle Isle. Construction, however, would not start within two years.

Thought has been given to providing navigators for the Great Lakes and West Coast. However, it is probable that some system of cost recovery from ships using the service would be necessary before expansion is approved by the government.

COMING EVENTS

August

- 16-18 2nd Internat. Electronic Circuit Packaging Symp. Univ. of Colorado, Boulder, Colo.
- 21-31 Conference on New Sources of Energy. United Nations, Rome.
- 22-25 WESCON. Cow Palace, San Francisco, Calif.
- 23-Sept. 2 1961 British Radio Show, Earls Court, London.

September

- 1-8 1961 Firato. Internat. Exhibition of Electronics. R.A.I. Exhibition Centre, Amsterdam.
- 4-8 Conf. on plasma physics and controlled nuclear fusion. Salzburg, Austria.
- 4-15 Internat. conf. on cosmic rays and the Earth storm. Kyoto, Japan.
- 5-8 Assoc. of Computing Machinery 1961 Conf. Statler Hilton Hotel, Los Angeles.
- 6-8 1961 Joint Nuclear Instrum. Symp. North Carolina State College, Raleigh, N.C.
- 11-12 Symp. on Nuclear Instrum., Atomic Research Establishment, Harwell, U.K.
- 11-15 16th Annual ISA Instrument-Automation Conf. Los Angeles.
- 14-25 National Exhibition of Radio and Television, Parc des Expositions, Paris.
- 20-21 Industrial Electronics Symp. Bradford Hotel, Boston.

Electronics Conference

The September issue of CEE will carry complete information about the 1961 IRE Canadian Electronics Conference, which will be held in Toronto, October 2-4. Included will be information about papers for the technical sessions, what the exhibitors will be showing, and notes on social activities.

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